Water management and modernization of the water sector in Syria, considering the German experience

by

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Abstract:

Water plays an essential role in human life as well as in various sectors of the economy, it is a strategic and crucial factor for achieving social and economic development and supporting ecological systems. However, the world's water resources are exposed to considerable and continuing pressure since the water use rate has increased twice as quickly as the rate of population growth during the 20th century, which led to malfunctions in the balance between renewable and available water resources and the growing demand for water.

Therefore, the issue of water is the main challenge to humans in the 21st century. Particularly affected by water scarcity is the Middle East, where the availability of water is less than 1,700 m^3 per capita per year. This dissertation focuses on the Syrian water sector, considering both aspects of administrative modernization and stakeholder approaches for ensuring the creation of an enabling environment capable of improving water management in Syria. The central goal of this research is to introduce a set of institutional, legislative and economic measures that can be used to rationalize and maintain the water resources in Syria to apply Integrated Water Resources Management (IWRM). Quantitative and qualitative data and methods were scrutinized to provide an overview of the status and problems of the water sector, as well as perspectives for innovative water management and corresponding modernization policies in Syria.

The thesis tackled the research questions defining the main challenges of the Syrian water sector and examining its existing enabling environment as well as its suitability for achieving sustainable water resources management. Furthermore, the study evaluated the existing governance regime and the institutional framework of the Syrian water sector, checked the availability, and estimated the degree of application of its management instruments. The research also examined the ongoing process of development and financing of water-infrastructure and finally estimated the overall impact of water resources management in Syria on economic, social, and environmental aspects. Finally, the study provides optimized recommendations and potential solutions for the development of the Syrian water sector according to the IWRM paradigm.

Key words: water management, integrated water resources management (IWRM), public participation, decentralization, public private partnerships (PPPs), management instruments.

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1. Introduction

1.1. Background and relevance

Water plays an essential role in our daily lives and in various sectors of the economy and is a strategic and crucial factor for achieving social and economic development and supporting ecological systems. The scarcity of freshwater recourses and the problems associated with that scarcity in the society, economy and environment represent a particular challenge, especially with regard to developing countries and regions of the world.

Since ancient times, humans have known that water is the basic requirement for life. Establishment of a fairer, prosperous and peaceful society requires the fair provision of safe water to all segments of society. People must secure the water needs for all water sectors, considering factors that guarantee the sustainability of this precious resource and its protection from pollution and exhaustion for future generations.

However, the world's water resources are exposed to considerable and continuing pressure since the water use rate has increased twice as quickly as the rate of population growth during the 20th century, which led to malfunctions in the balance between renewable and available water resources and the growing demand for water. Now, we find that about a third of the world's inhabitants is living in regions facing water crisis due to water shortage and two-thirds of the population worldwide are expected to be living under the pressure of lack of water by 2025.

The water resources that constitute the main base for development, health and food have become scarcer and more polluted. Water scarcity and pollution will lead to health and social problems, which are reflected in economic performance, causing harm to the ecosystem and threatening the food security of many countries. These conditions will lead to water disasters and confliction around water resource. Hence, the concept of water security, considered as an essential component of human security, was developed (UNDP; 2006).

Therefore, the issue of water is the main challenge to humans in the 21st century. Particularly affected by water scarcity is the Middle East, where the availability of water is less than 1,700 m^3 per capita per year. The water problem in the Middle East will increase dramatically over the next few decades due to population growth (Garnreiter & Schmid; 2002).

Recognizing this problem, the United Nations Conference on Environment and Development has suggested an increasingly integrated and sustainable use and management strategy in its strategic development for the 21st century: Integrated Water Resources Management (IWRM). According to the water sector guidelines, published by German Ministry for Development and Cooperation (2006), the relevant factors for efficient and effective water management are from a theoretical, interdisciplinary point of view, the following:

- Strengthening the political-institutional and administrative dimension of water resources management, accounting for decentralization, regulation and private sector involvement (PSP approach),
- Considering of economic issues, such as cost recovery, pricing and social justice issues that arise in this context,
- Designing legal dimensions, taking into account the legislation, technical regulations and standards,
- Considering the ecological dimension,
- Implementing a strategic approach, account for water demand management and planning of water usage (e.g., action plans, management and monitoring tools),
- Ensuring stakeholder participation,
- Setting basic didactics for capacity building in the area of water management (BMZ; 2006).

The concept of sustainability within the institutional framework must be expanded to include culture, religion and virtual water. For Middle East countries (such as Syria), water use has been influenced for centuries by religion. According to Maschner and Schomaker (2008), in Islam, as well as in the other monotheistic world religions Judaism and Christianity, water is of a great significance because of the geographical and climatic conditions in which these religions originated.

For Muslims, water is the source of life because God created everything out of the water. Thus, water in Islam means life, fertility and vegetation, while dryness is desert and expiry (Maschner & Schomaker; 2008). The introduction of IWRM means to advance administrative modernization, decentralization and good governance in the water sector, foster gender equality and contribute to economic and social development and achieving environmental sustainability.

1.2. Motivation

The global response to the call to preserve water resources and solve water problems worldwide requires all of us to perform in enhancing the management of water resources. Humans must ensure sustainability through the fair and equitable distribution of water within society and target higher economic efficiency.

The issues of water management and modernization of the water sector in Syria have not yet been fully explored scientifically. The limited number of studies in this concern have not led to practical implementations. One study examined the current situation of water resources in Syria

and recommended a restructuring of the water sector[1]. A general country study analysed the strengthening of links between water users, research and advisory institutions in Syria[2]. Nevertheless, there is a significant research gap within this field of research, which should be partially filled by this study.

There is clearly considerable need for scientific research in this area. By investigating the water sector in Syria, a scientific knowledge gain is expected, which can also influence practical application in a normative approach. This dissertation focuses on the Syrian water sector, considering both aspects of administrative modernization and stakeholder approaches for ensuring the creation of an enabling environment capable of improving water management in Syria.

In this framework, recovering and updating the development plans of the water sector in Syria is essential. This plans aim to improve water supply and sanitation management and lay the foundation for IWRM, with the goal of protecting the country`s water resources and improving the Syrian people's living conditions.

There are a number of reasons for selecting this topic: demographic trends and structural features (for example, the agricultural sector accounts for around 85% of total water consumption in Syria); an overuse of available water resources, resulting in sinking of groundwater levels and a decreasing water supply; water quality degradation and rising production costs. In addition, the existing high cost of water availability for different purposes is a relevant factor. This cost is caused by the cost structure of many projects, such as dams and hydropower plants, which are characterized by high sunk costs. Infrastructure projects increase further inefficiencies in the management of this type of water, so there is no cost recovery during the process of exploitation of water projects.

Improving the water resources management approach depends on decision-making from the beginning of the planning process to the contribution of all stakeholders in this process to achieve the IWRM.

The concept of IWRM offers solutions to the water resource crises by linking water resources with other vital resources and comprehensively examining the entire water cycle, considering humans as the basis for sustainable water management. Because the concept is comparatively

[1] Kaisi, A; (2007); Water Resources in Syria Usage and management.
[2] Daoud, M, D / Kaisi, A; (2000); Strengthening the linkages between water users and research and extension institutions in Syria.

new, there is a need to train experts on integrated management of water resources to add to their knowledge and hone their expertise. Integrated management of water resources must be common to form the basic language of work in future water resources management.

1.3 Objectives of the thesis and research questions

In the recent years, water use has resulted in irrational practices causing damage to natural resources. There is a need to investigate the water sector in Syria for guaranteeing sustainable management of water resources. Therefore, this research aims to evaluate the current water management process in Syria in the light of strategies and water policies recommended by the United Nations. The goal is to introduce a set of institutional, legislative and economic measures, which rationalize and maintain the water resources to apply IWRM.

The objectives of this study are as follows:

- To define the challenges of the Syrian water sector and to examine the existing enabling environment and its appropriateness to contest these challenges and achieve sustainable water resources management,
- To evaluate the present governance and institutional framework of the Syrian water sector,
- To check the availability and estimate the degree of application of required water management instrument,
- To examine the on-going process of development and financing of water-infrastructure,
- To estimate the overall impact of developed water resources management on economic, social and environmental aspects in Syria.

The above objectives are reflected in the following research questions:

- Is the enabling environment within the water sector suitable for meeting the challenges of water resources and achieving sustainable water resources management?
- Is the existing governance system and institutional framework suitable for managing water resources in a sustainable way?
- Are the availability and level of application of management instruments according to the IWRM paradigm?
- How well is the process of development and financing of water infrastructure applied?
- Is the overall impact of developed water resources management on the economic, social and environmental aspects in Syria positive?

1.4. Methodology

To evaluate the research questions, this study employed information from both a questionnaire survey and relevant literature. Methodologically, the research study used a mixed approach; both quantitative and qualitative research methods were applied to gain an overview of the status, problems and perspectives of water management and corresponding modernization policies in Syria.

The aim of the work is to uncover organizational and structural shortcomings of the water sector, to analyse the causes of these shortcomings and to cluster them in groups. Based on analysis of Syrian water sector, optimization recommendations were developed.

The survey's target group were key stakeholders in the water sector in Syria (decision makers and employees). The survey provided a greater qualitative understanding of Syrian familiarities in the application of integrated methods to the development, management and use of water resources as agreed in Rio 1992 (chapter 18 of Agenda 21), in Johannesburg 2002 (the Johannesburg plan of Implementation) and in the Water Strategy of Syria developed by the cooperation with the German Ministry for Economic Cooperation and Development, 2003.

The survey results provided insights into the water situation in Syria and establish the foundation for informed decision-making in the Syrian water sector for promoting sustainable water resources management.

In this context, two newly developed questionnaires were used for data collection in this research:

- A preliminary or exploratory water expert survey containing broad open-ended questions for a selected group of three experts,
- A general water expert survey, which used the findings from the first exploratory survey to address all sides of water issue using different types of questions (both open-ended and closed questions), for a selected group of 22 water experts.

The survey results were triangulated with existing literature for further validation and to expand the outreach and the transferability analyses since the consilience with the studied literature on the topic supports the reliability of the data, especially when the literature findings lead to the same or similar conclusions as the survey results.

1.5. Summary of the structure of the thesis

The study is structured in seven chapters. After this chapter, which included an introduction to the research study's relevance, objectives and methodology, the second chapter addresses the

theory of water and water management, including facts and figures about water, water cycles and water systems, the values and economics of water and the global and regional water management crises. Chapter 3 provides a scholarly review of the concept of IWRM. This review discusses IWRM's historical background, purpose and objectives, main principles and components (such as demand management, decentralization and subsidiarity, public and citizens participation and public private participations [PPPs]), challenges and critical analysis of the concept as a theoretical body and in its application general.

The forth chapter presents a Syrian example, discussing the framework conditions, water and water Governance and challenges for the water resources in Syria. Chapter 5 reviews the applied methods of this research study, the utilized research instruments (the Survey of Water Experts) and the selection of the target group. The sixth chapter provides the findings from the survey and empirical analysis and formulates an interim conclusion. Finally, based on the results of the water expert survey, Chapter 7 includes a general conclusion and policy recommendations for decision making in the water management process in the Syrian water sector.

2. Theory of water and water management

2.1. Facts and figures about water

The international network for capacity building in IWRM (Cap-Net; 2005) has outlined the water problem as follows:

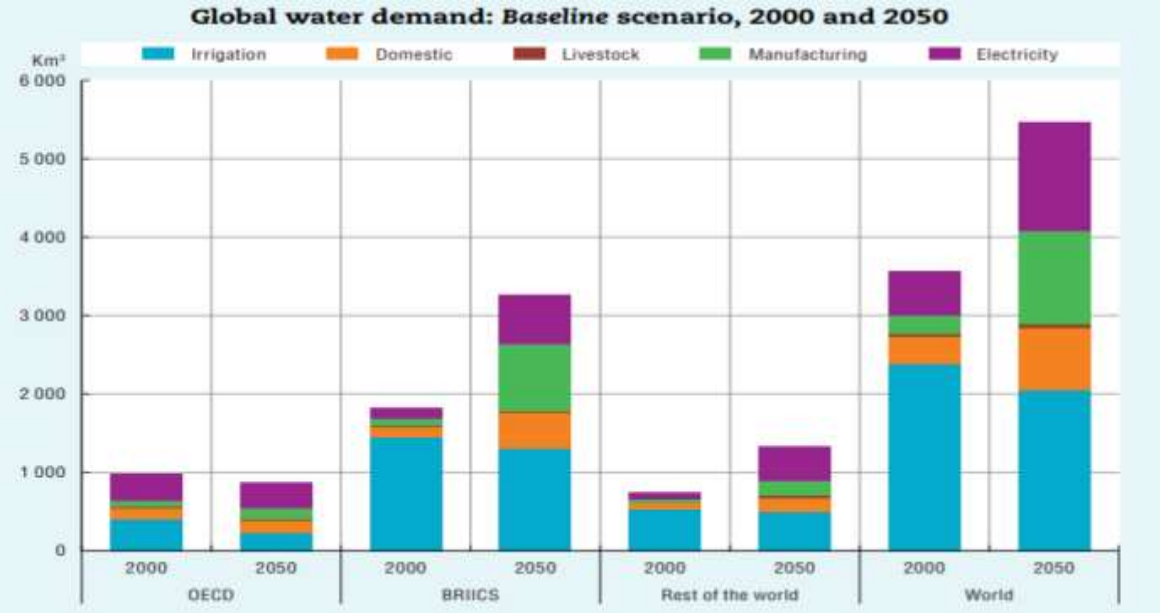
- Global water is 97% salty water and 3% potable water, and of the 3% potable water, the 87% is not available. Thus, estimated available fresh water is only 0.4% of the total global water.
- More than two million people are affected by water scarcities in more than 40 states.
- There are 263 river basins common between two or more countries.
- Nearly 2 million tons per day of waste are thrown into waterways.
- Half the inhabitants of developing nations are vulnerable to contaminated water sources, which raises the incidence of diseases.
- 90% percent of natural catastrophes were connected to water.
- The increase in the number of the world's population, from six to nine billion, will be the primary motivation for the rational management of water resources (Cap-Net; 2005).

According to Gorbachev (2010), the United Nation estimates nearly 900 million people suffer from clean water shortage and 2.6 billion live without adequate sanitation. Many people die

every year due water related diseases. Recognizing that access to clean water and sanitation is a human right is basic for saving people's lives (Gorbachev; 2010).

According to the estimations of the Organization of Economic Cooperation and Development (OECD) water demand is expected to increase worldwide between 2000 and 2050 (see Figure 1) (OECD; 2012; P: 208).

Figure 1- Global Water Demand.



Source: OECD; 2012.

2.2. Water cycle and water systems

The water cycle is part of the natural hydrological cycle, obtains precipitation from the atmosphere, and has two interconnected components: surface water and subsurface water or groundwater. The water in nature moves toward the level, which ensures the reduction of its kinetic energy potential to a minimum extent. This movement is called water flow, which is divided into surface water flow (like streams, rivers, and glaciers) and ground water flow (like in different water tables, which can be pressurized or free non-pressurized).

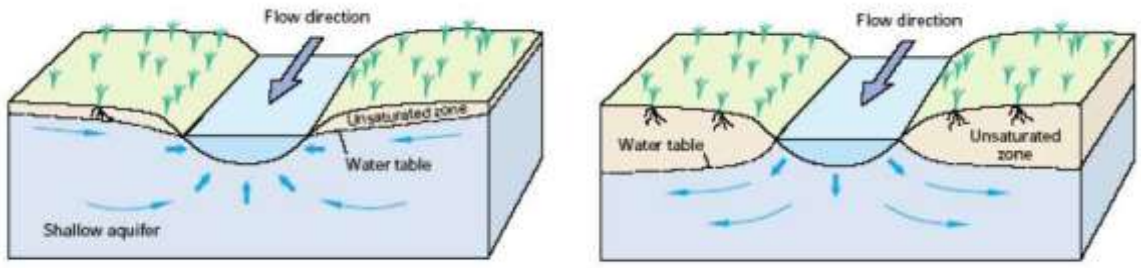
The natural and geographical component emerged from the entire lands on which and under which the water moves until a monitoring location is called watershed for this location.

The water flow or kinetic transition of water begins from the precipitation site and ends at the final estuary, which might be inland or within seas and oceans.

However, the naming hydrological basin is linked in scientific and practical concepts to the physically clearly defined surface water flow.

The various traditional sources of water (surface and groundwater) are hydraulically linked to each other (see Figure 2) where the nutrition accrues directly between these two sources until they reach their final estuary (Daoud; 2013; in Arabic).

Figure 2- Hydraulic link between surface and groundwater.



Source: Daoud; 2013.

2.3. Water as a natural good and an infrastructure good

Water, which keeps us healthy and strengthens industry and economy, comes to us via nature. Water is naturally stored by forests, aquifers, soils, lakes, and wetlands. Rivers deliver and convey water to us. The nature infrastructure provides these services similar to conventional infrastructure, like dams, reservoirs, and canals (IUCN; 2015). Water supply and sanitation are classic infrastructure goods. These are goods and services of general interest (i.e., beyond commercial interest) (Schomaker; 2010). The marketing of water, as well as other natural resources, is considered a feature of today's globalization. The common good is a major concern of capitalism, and new industries that market to the remaining community life are increasing. Biotechnology as an example.

Corporations desire to negotiation for water, a vital raw material, because it is profitable. Today, the highest bidders for sale are the state property, genes, and water (Barlow et. al; 2005).

2.4. Economics of water management

In many cases, water is offered for free. As a result, we waste it, pollute it, or ignore its destructive power. Therefore, people must be conscious of the value of water and protect the ecosystem. For water scarcity and lack of water supply, recognizing the full range of direct and indirect water-related benefits and risks, including economic, social, and cultural values, is essential. The United Nation’s General Assembly has prioritized satisfying human needs and recognized general access to clean drinking water and sanitation as a human right. After basic needs are met, water can be moved to the usage that has the maximum value and can be considered as an economic good (HLPW, 2018; Shataniwi & Naber, 2011).

2.4.1. Water as an economic good

The consideration of water as human right does not mean having water for free or being able to consume unlimited amounts of water. The resource limitations, the necessity to conserve natural ecosystems, and economic and political factors limit water availability. Water availability has such restrictions: the needed amounts of water to satisfy this right, to keep people alive, to cultivate food to sustain life and to maintain certain economic levels.

The international negotiations over improvement, investigation of human rights literature, and the consideration of human desires and uses of water address these restrictions. The human right to water is mostly valid for drinking, cooking, and fundamental household uses.

The human rights literature insists on providing sufficient water to sustain human life but does not answer this question: At what cost should this water be provided? Should the water be provided free of charge?. However, the international water committee is progressively aware of the economics of water (Gleick; 2007). Water is a basic element for satisfying several human needs and services, which are known as life-support functions. The actual use of water can be both social and an economic good. Living system, including humans, require safe access of water. However, in some cases, water has definite uses as market goods. The benefits of such uses can be maximized through competitive allocation (Atapattu; 2000).

Until recently, water was available and abundant in many regions of the world, so it was considered a free commodity.

However, the developments that occurred after the Industrial Revolution, the high rates of population growth, and the expansion of urban areas led to the depletion of water resources, and the water became a scarce substance.

According to Hanemann, water has an importance not possessed by most other commodities (Hanemann; 2005). If we become aware that there is no substitute for water, we should deal with water as a resource, which has an economic worth in all aspects of its uses.

The economic value of water is a monetary gauge by which we can estimate the customers' desires, satisfaction, and ability to pay for the provision of water services within certain specifications.

Most of the previously mentioned failures in managing water can be attributed to water being seen as free, or at least the total value of water not being correctly identified. Competition for scarce water resources can lead to irrational distribution and less important uses of water and will not provide an incentive to manage water as a restricted asset. To elicit the highest profits

from the available and limited water resources, a change in the views of the value of water as an economic good is needed.

The unique characteristics of water resources in trade market, other than natural resources, such as coal, oil, fish, yields, and wood, makes its allocation inefficient and inequitable. Considering these characteristics leads to questions of whether water should be considered a public or a private good. The water used in the household, for example, for drinking, gardening, and showering may create a rivalry because a person drinking a glass of water can avoid others from drinking it. Such a good is private, like clothes, cars, and books. Most of these private properties are allocated to their maximum worth uses, but water is exceptional and exists both as a private marketable good and a elementary human right (White; 2015).
The dichotomy between private and public goods has expanded to cover common resources and club resources based on exclusion and rivalry concepts (Ostrom; 2010). These two notions express the main features of goods (and services) (Randall; 1983).

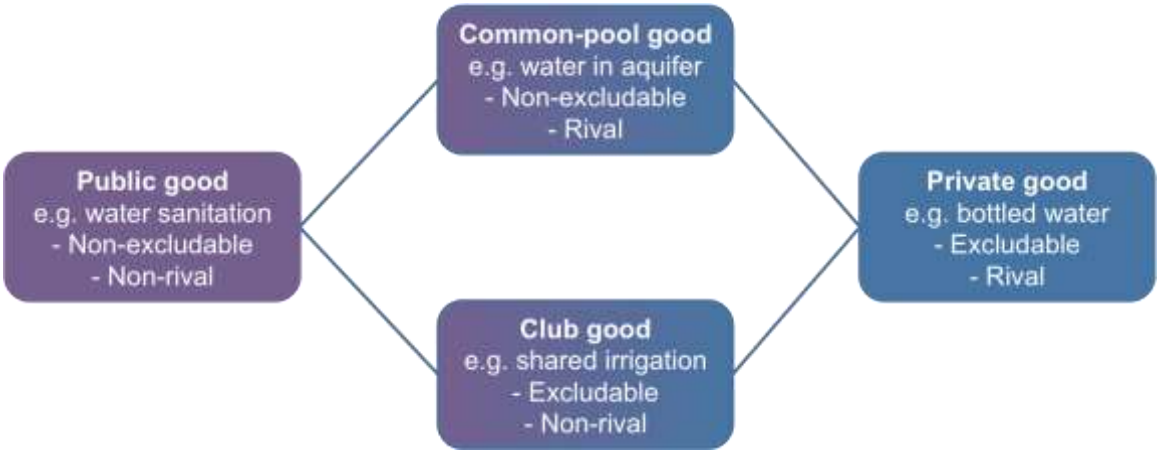
Rivalry reveals the grade to which the use of an item or a good by one individual decreases, or does not decrease, the potential for others to use that same item.

Exclusion refers to whether it is easy or hard (i.e., expensive) to except or limit consumption by other possible consumers or beneficiaries.

Economists describe *private goods* as the properties that are excludable and rivalrous and *public goods* as almost non-excludable and are non-rival. *Common pool* resources are similar to public goods in that they do not offer themselves simply to exclusion, but their consumption is open to overuse. As long as the total demand does not exceed the productive capacity of the resource, the consumers can use the good without threatening other consumers' needs. However, when availability is less than demand, the open access resources can be overused due to lack of ownership and control. *Club goods* are excludable and non-rivalrous and may limit their degradation by allowing a defined group to enjoy the benefits (Aylward; 2016). For example, a participatory irrigation project allows only the members of the project to benefit from it.

Thus, water can be a public good, a private good or a combination (see Figure 3).

Figure 3- Water as a public and private good**.**



Source: White; 2015.

2.4.2. Value and pricing

There is a talk caring about the social concerns of the concept of 'economic goods' and how this concept can disturb the access of poor people to water.

Whereas Dublin's principles indicate that water is an economic good, it may refer to the water as an economic and social good in Chapter 18 of Agenda 21.

To escape this misperception, there is a need to differentiate between the value of water and the fees for water.

The value of water is essential for national planning for the distribution of water resources as a scarce resource through controlling or economic measures. According to GWP; (2005), the pricing of water acts as an economic tool to offer incentives for managing water demand, ensuring cost recovery and demonstrating users' readiness to pay for supplementary investments in water services (Cap-Net; 2005). According to Abed Rabbouh (2013), determining the economic value of water is important for the following reasons:

- Enables the decision-makers in the field of water resources management to make sound decisions with respect to investments in water projects.
- Helps laying the necessary foundations to achieve effective management of water in light of the declining ability of water resources to meet consumers' needs.

- Provides answers to many questions relating to the priorities of the use and re-sharing of water quotas and the transfer of the rights of utilization of water resources between consuming water sectors (Abed Rabbouh; 2013; in Arabic).

According to (FAO;1993), determining the economic value of water is one of the main challenges for the economists and analysts due to several overlapping factors that affect the value of water. These factors can be summarized as follows:

- Some characteristics of water distinguish it from other substances. Physically, water is a liquid that flows, evaporates, freezes, and moves within the hydrological cycle, sometimes on the surface of the earth, sometimes inside, and other times in the air. Therefore, economists consider it a material with exceptional properties, which make determining its value difficult.
- Water in most countries is not subordinated to free market policies (the laws of supply and demand). Therefore, to deal with water on the basis that it is a good market limits the possibility of the application of traditional economic theories used to determine the worth of water.
- The economic value of water is related to its different uses. In irrigation, for example, the definition 'private good' is applied when this good is used by a particular consumer, other consumers are affected by the result of this use. In this case, water has certain value. Conversely, using water for recreation makes it a public good and the use does not affect the others, so it has value different from the previous value.
- The economic value of water is linked to its presence in a specific place and time, so the value of water underground at great depths differs from that in the surface bodies, such as lakes and rivers. Furthermore, the value of water in the summer, when temperatures are high, varies from the value of water in the winter.
- The goodness of water and the continuation of the water supply have a great influence in determining the economic value of water (FAO; 1993).

Dealing with water as an economic good could help achieve a balance in water's supply and demand, thus ensuring the continued stream of properties and services from this natural and public resource.

When water becomes limited, continuity in a traditional policy for increasing supplies is not a practical choice. There is a clear need for an economic concepts and devices that can assist in managing and determining the demand for water.

According to Cantin et. al; (2005), the estimation of the cost of the water does not prevent governments from providing purposeful and transparent subsidies for poor and vulnerable people in appreciation of the social value of water. Furthermore, water pricing policies must be accompanied by purposeful and transparent aids for groups and individuals with low incomes to allow them to meet their basic needs and encourage the participation of the users in decision-making.

This pricing method will attract infrastructure investments and private sector participation and will provide the needed income to cover operating and maintenance costs (Cantin et. al; 2005).

One of the greatest aspects of water resource management is water economics, which desires to be well-adjusted with cultural and public concerns. Giving water its economic value good is theoretically possible but, in the practice, is one of the extreme challenges in water resource management. Water is used in industry and energy sectors. The amounts of water used, the cost of investment for providing water, and the significance of the output production are of great importance. According water its economic value and enabling a country's water economy to be incorporated into the broader national economy are the aims of treating water as an economic good.

The most gentle and complex issue in the consideration of water as an economic good is mainstreaming the balance between securing affordable water for elementary human needs for the poor and ensuring, when water is consumed for other beneficiary uses, it is correctly and appropriately valued (Martino; 2003).

According to economic theory water has financial value when its supply is limited in relation to its demand. When the water supply is limitless, water is free in an economic sense. The economic value appears when many users compete for its use. The price of water in a market system defines the economic value of water, which serves as guide for allocating water among alternative users targeting the greatest total economic return by potentially guiding water and its complementary resources into different water usages.

The economic value of water is defined as the quantity that a rational consumer of publicly or privately delivered water is ready to pay for it (Ward & Michelsen; 2002).

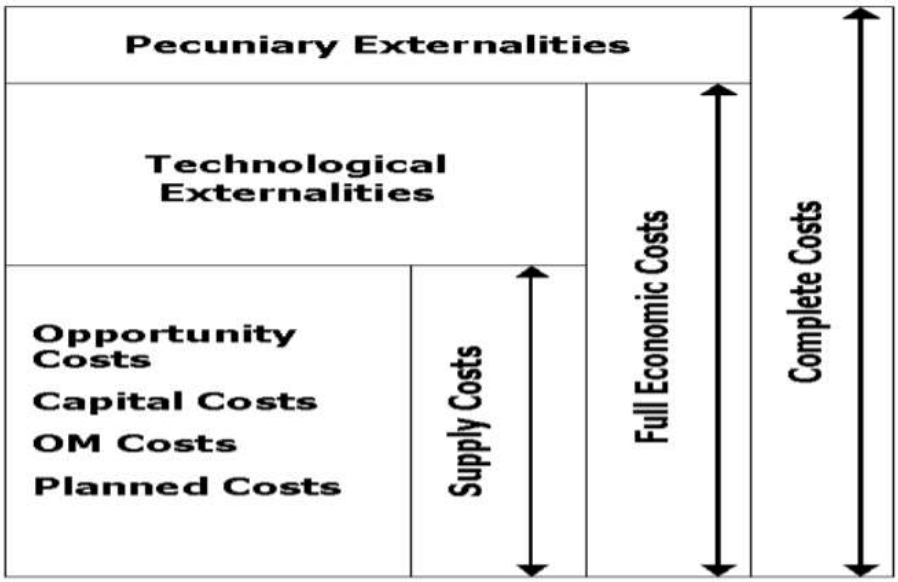
2.4.3. Value and cost analyses

The cost and value analysis by Matthews et al. (2002) discussed the components of economic analysis and the understanding of 'complete' value and costs. This analysis identified values under the domain of economic analysis, values other than economic, and economic values. Figures 4 and 5 present these classifications. In Figure 4, efficiency analyses (the typical domain of economics) was distinguished from other values (e.g., cultural, religious). The efficiency category contains two main goods traditionally traded by market: private goods (like apples and oranges) and non-market or communal goods (like air quality and water resource conservation). The full economic value in this case is the sum of these two types of goods. In addition, other values, such as culture and religion, may be present.

Figure 5 present the subject of dominance cost analyses. The full economic cost contain concepts such as investment costs and operation and maintenance cost (O&M) and technological externalities. Technological externalities are expenditures that can be dropped to others' activities. For example, if the water upstream is polluted by a factory, the people downstream will have to purify the water before consuming it for drinking. Financial externalities are those that appear through the price structure. Therefore, complete economic costs include both financial and full economic cost (Matthews et. al; 2001).

Figure 4- Value analysis: Matthews et. al; 2001.

Figure 5- Cost analysis: Matthews et. al; 2001.



2.5. The environmental value of water

The total value of water includes non-economic values, counting social equity and environmental stability. The market and non-market values should be equally considered when defining the economic value of water. Economic efficiency alone is not enough for optimal valuation of water, so the value of water should consider all values: economic, social, strategic, atmospheric, and so on. The environmental value is included in the economic value. The optimal resource allocation should consider the environment externalities, which usually represent real costs or real welfare changes. The ignorance of environmental externalities is considered possible resource misallocation and can increase distribution or equity problems. The estimation of environmental value is a difficult issue. Therefore, we need economics to provide numbers that support targeting social equity and ecosystem sustainability (Matthews; 2001).

The polluter pay principle

The *polluter pay principle* (PPP) is closely related to the principle of *equity* known to the common law system. This principle aims to make the polluter responsible for the pollution he or she has caused and accountable to the other partners who did not contribute to the contamination in costs and penalties. The PPP can be used to distribute the pollution damage costs equally between the polluter and the general public (Hilson; 2000). One useful approach is to consider the PPP from the *efficiency* point of view. In this viewpoint, the PPP is considered

a rational economic means to achieve more efficient allocation of resources in economic production. Since pollution is a negative environmental activity or side-effect of economic activity, the inclusion of such negative externalities in the cost of the product is the main purpose of PPP. Thus, the costs of a product's pollution are reflected in the price that the polluters (producers and consumers) bear and not the whole society (Sadeleer; 1999).

The PPP was referred to first by OECD Recommendation (1972) on the Guiding Principles regarding the International Economic Aspects of Environmental Policies (OECD; 1992).

Recognized in international environmental law as a general principle, the PPP has been integrated into specified soft law instruments, such as the UN Rio 1992 (UN; 1992). The market-based instruments, aimed to internalize the negative environmental externalities of human activities, started with the PPP. Article 9 (para. 1) of the Water Framework Directive (WFD) establishes member states have to consider water services cost recovery principle, containing environmental and resource cost, in accordance with the PPP and economic analysis conducted, according to Annex III.

Cost recovery describes a structure of collecting water service costs, appropriate contribution of different water services to cost of water services as second indent, obligation of the member states to provide fragmentation the water use into household, industry and agriculture. Not only the financial costs of the water services should be recovered, but also the environmental and resource costs[3] must be included (Lindhout; et. al; 2014).

2.6. Water as social good and a basic human need

Without water, there is no life, no commercial production, and no environment. All human activities depend on this vital resource. Thus, water is essential (Savenije; 2002).
According to Shatanawi`s presentation (2009) to the International Conference 'Water and Peace' held in Brussels (12-13 February 2009):

> Water is the source of life and it is the first element of everything living. Without water there will be no life because human beings, animals, plants, etc… need water every day for their continuity and survival. As water is a common resource, everybody has the right to use it. But water availability is limited to resource constraints. Giving such

[3] Environmental costs reflect the expenses of destruction that water uses impose on the environment, on ecosystems, and on habitants of the environment. Examples of these expenses are a decrease in environmental quality of marine ecosystems or salinization and degradation of fruitful lands. Resource costs characterize costs related to foregone opportunities which other (resource) users suffer due to depletion of the resource beyond its recovery rate. These costs are, for example, related to lost opportunities due to over-abstraction of groundwater (Djuma; et. al; 2012).

> constraints on water availability, how much water is needed to satisfy this right? The answer to this question came out from discussing the human right issue and the understanding of human needs and uses for water (Shatanawi; 2009; P: 3).

The concept of basic needs was among those raised concept raised during the 1977 Mar del Plata Conference. The Action Plan from the United Nations Water Conference approved water as a right for the first time announcing that:

> All peoples, whatever their stage of development and social and economic conditions, have the right to have access to drinking water in quantities and of a quality equal to their basic needs (UN; 2005).

The Earth Summit in Rio de Janeiro in 1992 confirmed this concept and extended it to enclose environmental water needs.

In developing and exhausting water resources, primacy has to be given to satisfying the elementary desires and the conservation of basic necessities and the ecosystem (Gleick; 1996).

Since General Comment on the right to water was developed by the UN Covenant Rights and the Committee on Economic, Social, and Cultural Rights (CESCR), in 2002, water was recognized as a basic human right. This covenant was approved by 145 countries emphasizing that every person has the right to harmless and protected potable water, fairly and without discrimination. General comment 15:2 provides that, 'the human right to water entitles everyone to sufficient; affordable physically accessible; save and acceptable water for personal and domestic uses'. The governments need to approve national policy and action plans, which enable them to move rapidly and efficiently toward the complete realization of the right to water. These strategies should meet the following criteria:

- Be grounded on human rights law,
- Enclose all characteristics of the right to water and the equivalent responsibilities of the country,
- Outline defined goals,
- Set targets to be realized and a timeframe for their realization,
- Frame suitable plans and equivalent indicators (CESCR; 2003).

Access to this essential good is recognized by the law because the whole society must bear responsibility for providing its population with water. The water supply is regarded as an elementary social duty and has a long-term ecological and economic importance (Barlow et, al; 2005).

2.7. The global and regional water management crisis

Water is the source of life and livelihood and is necessary to achieve sustainable development (UNU-INWEH; 2015). Sectorial management has dominated the management of water resources previously and is still dominant, which leads to the uneven and inconsistent management and development of the resource. Moreover, water management is usually under the supervision of public institutions. However, these institutions efficiency is progressively more questioned (Cap-Net; 2005).

Poor management leads to increased competition for limited resources, while the integrated management of water resources creates coordination and cooperation among different sectors in addition to enhancing the participation of stakeholders and increasing transparency and an effective local administration in terms of the costs.

The limitation of available freshwater resources is considered one of the central challenges facing countries, especially those located within the arid and semi-arid regions, like Syria. Furthermore, justice in water management and sustainability of the world's major challenges must be met to hold the Millennium Development Goals (MDGs)[4]. One-third of the world's inhabitants is now living in states suffering moderate or high pressure regarding water.

The water supply for meeting the human needs will be more difficult in view of currently expected population growth, industrial development, and expansion of the agricultural area within the next two decades. The challenge of security of water demand will be more complicated in some areas due to water issues linked to climate change.

According to the United Nations World Water Development Policies (2015), these challenges are reflected in the following components:

- The scarcity of fresh-water resources and increased vulnerability to the results of climate change, desertification, and the expansion and extension of drought periods and floods,
- The growing demand for water to secure the necessities of population growth and sufficient food production and increasing competition among domestic, industrial, agricultural and tourism water using sectors.
- The increased risks of high pollution levels and the difficulty of controlling the spread of pollutants and their impact on the ecosystem,

[4] The Millennium Development Goals 'are an ambitious agenda for reducing poverty and improving lives that world leaders agreed on at the Millennium Summit in September 2000' (Cap-Net; 2005).

- The weakness of the administrative, institutional, and legislative systems in managing various aspects of the water sector,
- The limited role of the local community and public participation regarding water sector management,
- Weak cooperation between the various parties involved in the field of shared water management at national, regional, and international levels (WWDR; 2015).

Therefore, there must be a coordinated response to these challenges, as it appears that the existing institutional mechanisms, which are currently directed to the implementation of sustainable water management are insufficient and the world is not likely to look at measures relating to the management of water as if it were a marginal things.

2.7.1. Challenges facing the water resources

2.7.1.1. Securing water for people

While most countries give highest primacy to sustaining the elementary human desires of water, a fifth of the world's inhabitants have no access to non-toxic drinking water and half the population is lacking access to sufficient sanitation facilities (Cap-net; 2008).

These deficiencies in water-related services mainly disturb the poor slices of the people in developing nations. To meet the requirements of water supply and wastewater discharge in rural civilian regions is the most serious challenge of the coming years.

One of the MDGs was to reduce the amount of the residents that lacks water and sanitation facilities by 2015. Of the 2.6 billion people who have obtained access to enhanced potable water since 1990, 1.9 billion obtained access to pipe-lined domestic water. Over half of the global population (58 %) now is delighted in this higher level of service (MDG; 2015).

To secure the supply of drinking water for the rest of the population, we need to re-direct substantial investment priorities that are easier to accomplish in countries that apply the IWRM system.

2.7.1.2. Water supply for food production

Population prognoses point out that over the next 25 years, nutrition production must be secured for the remaining two to three billion people, and water is increasingly considered a key obstacle to food production, equivalent to if not more important than the scarcity of agricultural land.

Watered agriculture is responsible for 70% to 90% of all water extractions. With an estimated increase of 15% to 20% over the next 25 years, permanent conflicts between the use of water for irrigated agriculture and other water uses are likely to arise. The IWRM enables increased efficiencies, water safeguarding, and demand management for rightful allocation of water

among water users. In addition, the IWRM may raise the recycling efficiency and wastewater reuse to add a new development and non-traditional source of water (Cap-Net; 2008).

2.7.1.3. Protecting the environment

Human development activities have resulted in degradation of water quality and quantity. Water has become more polluted by civil waste disposal, agricultural fertilizers, and pesticides. Many ecosystems and communities that depend on natural resources are affected by irrational use of water resources (2iE; 2010).

2.7.1.4. Gender inequalities

The growing number of men and the low representation of women in water institutions means formal water management is male dominated. Women are mainly stakeholders in domestic water and sanitation as guardians of family healthiness and hygiene and providers of household water and food. However, decisions on water-related issues, such as water supply and sanitation technologies and operation and maintenance of water systems, are almost all organised by men. All water users from different segments of society, poor and rich, male and female, must have equivalent opportunities in the water management and decision-making process (Cap-Net; 2008).

2.7.2. The orientation toward IWRM

Since recent water uses have resulted in escalating and unsustainable practices, the states have to review and develop their strategies and water policies and introduce a set of institutional, legislative, and economic measures. These measure should aim to rationalize the management and maintenance of water resources to apply an IWRM.

A water management system has become necessary as an anthropogenic intervention in the water cycle and other activities that endanger groundwater have increased water consumption and water pollution (Shaker et. al; 2006). The concept of IWRM is widely discussed at the international level and is one of the key concepts of international water policy interest (Hartje; 2002). Water management has developed over the years in response to special needs without establishing an overall balance between those needs or coordination between sectors. The result was the presence of sectorial indicators (each sector separately) in the management and use of water, which led to ineffective and fragmented water management and water management approaches remaining dependent on sectorial divisions (Abed Rabbouh; 2013, in Arabic).

Experts and researchers have been taking the following actions to orientate the global water policy toward IWRM:

- Reviewing the global water facts that form significant challenges in the exploitation of water,
- Considering urgent measures to prevent the emergence of water crisis,
- Accounting for the associated water resources management crisis's need to provide water for people, produce food, and protect ecosystems,
- Bearing in mind the importance of concentrating on the role of women in managing water.

The solution to the scarcity of water resources and their good management lies in working according to the concept of integrated management. This concept is key to water policies and considers the relationship of water and the geographical, climatic, social, political, economic, and hydrologic cycle characteristics. This concept focuses on the idea of complementarity between the natural and human systems and balance in the pattern of consumption in accordance with the amount of available water and participation and consensus among stakeholders from consumer groups to water and those in charge of managing water to achieve justice among consumers and ensure a balance of environmental and the gender issues.

3. The concept of IWRM

3.1. Background and history

The general public´s support of the need for sustainable development was more noticeable after the publication of the book, *Silent Spring* (Carson; 1962). Carson pointed out the negative effects of pesticides and the dreary future of the environment and human beings if such pesticide use continued. The United Nations Conference on the Human Environment (UN; 1972) considered the necessity for a collective outlook to motivate and guide people in the protection and enhancement of the surrounding eco-system. The conference recorded 26 principles addressing the necessity to protect natural resources by means of careful planning and management and called on states for an incorporated and coordinated attitude towards development plans. The World Commission on Environment and Development promoted these principles in their report, 'Our Common Future', insisting that the strategy of sustainable development aims to enhance synchronisation among human beings and between humankind and environment (Brundtland; 1987). Common concerns and challenges were identified, and popular methods for securing sustainable development were suggested in this report.

The last three decades of the last century have awakened the awareness of the international community, governments, and politicians about the long-term implications of a sectorial and fragmented approach in water resources management. Thus, many conferences and debates about economic and social value of water, and the technical, legal, and financial tools used in its governance, occurred. These debates led to a consensus on the need to adopt and publish the principle of integrated management of water resources to ensure water sustainability (Rahaman and Varis; 2005).

The milestone of the IWRM concept was developed and internationally recognized in 1992 in Dublin, where the guiding principles were stated. The second milestone incident, in 1992, was the United Nation Conference on the Environment in Rio de Janeiro, where Agenda 21 on the 'Integrated Management and Development of Water Resources' was developed by the world's governments. This commitment was confirmed later, in 2002, in Johannesburg, where the 'Integrated Water Resources Management & Water Efficiency Plan' was developed (UN; 2002). Thus, IWRM has developed into an institutionalized discourse on the international level (Conca; 2006; Mukhtarov; 2009).

The global water partnership has defined the IWRM as 'the process of promoting and development of water resources and land management coordination and the related to them

other sources in order to maximize the economic benefits and social welfare without neglecting the sustainability of vital environmental systems' (GWP; 2004; P: 15).

A further practical definition is used by the United States Agency for International Development (USAID): 'IWRM is a participatory planning and implementation process, based on sound science, which brings together stakeholders to determine how to meet society's long-term needs for water and coastal resources while maintaining essential ecological services and economic benefits' (USAID; 2009).

The definitions presented confirm that the IWRM will support the protection of global environment, accelerating economic progress, supporting agricultural development, and promoting representative participation in the improvement of human health and water governance.

According to the World Bank Institute, the following key activities are part of the overall definitions of IWRM:

- Coordinating the process between all parties involved,
- Focusing on both the social and economic well-being and protection of environments,
- Using scientific data and tools to support logical prosecution,
- Emphasizing appropriate governance, which includes democratic participation (Xie; 2006).

The integrated management of water resources is not just a final product but is a dynamic process evolved spontaneously in stages and which provides a balance between the means and the tools and curriculums needed to advance and manage water and related resources to achieve security and water sustainability.

Furthermore, in IWRM, the application of any policy or new management tool may require adjusting the current policies and developing a new vision because this integration approach is inconsistent with the existing trends and institutional arrangements and with the goals and forms of sectorial policies. The realization of that purpose is not easy and can be achieved only gradually by developing the capabilities and necessary mechanisms.

3.2 The purpose and objectives of IWRM

The goal of IWRM, as the Agenda of the 21st Century states in Chapter 18, protection of the quality and supply of freshwater resources: application of integrated approaches to the development, management and use of water'(UN; 1992).

Therefore, the IWRM was found to help countries in their efforts to effectively and sustainably deal with water issues.

Many of the countries in the world are struggling with economic and social development challenges associated with water resources. Furthermore, the growing demand of water and the deterioration of its quality and quantity, as well as the inadequate management of natural resources, makes water a limited and unprotected resource. This situation is evident in the Middle East, where sectorial approaches to water management are dominant in many countries and cannot meet the requirements for sustainable management of resources.

The region needs a comprehensive administrative strategy, dealing with the entire water cycle and integrated with environmental, social, and economic factors. From this perspective, the IWRM helps protect the environment and increases the speed of economic growth and sustainable agricultural development. This strategy also promotes participation in water management and improves human health.

According to Batchelor (2008), the three basic concepts of equity, efficiency, and sustainability are presented within the theory of IWRM, which aims to achieve the following:

- Secure an adequate clean water supply for all urban and rural community groups,
- Ensure water supply meets food needs,
- Guarantee water supply meets the social and economic development requirements,
- Adopt a flexible approach and a holistic perspective to deal with the demographic, economic, and environmental variables that affect the status of water resources by formulating and implementing policies and strategies to realize sustainability in development and management of water resources,
- Raise responsiveness of water issues and public involvement in water resources management,
- Achieve cooperation among the states that share water resources to settle water conflicts (Batchelor; 2008).

3.3. Basic concepts of IWRM

The concept of IWRM was globally adopted under Agenda 21 on the protection of freshwater resources and their supply. The application of an integrated approach to water resources improvement, management, and exploitation is considered one of the most modern methods to achieve optimal development of all conventional and non-conventional water resources and

rationalizing their use and sustainability in the household, industrial, agricultural and tourism sectors.

3.3.1. The natural and human systems interaction

The term IWRM, as stated in the literature, is understood as a concept of social ecology. This chronological review proposes that at each stage of the concept's evolution, as well as in its implementation, external influences are generated. These influences suggest a complex, as well as compound, relationship between the natural systems and human, where the internalization of many structures previously observed as external conditions is a feature of adaptation and adaptability in the management of water resources in an integrated method. Specific consideration is given to basin management processes, and their effectiveness in determining environmental processes, as well as feedback on techniques to reduce energy used in the planning process.

Interaction between land, water, and ecosystem occurred in second generation of IWRM, especially after the 1990s, when managing water resources began to be perceived as integrated land and water resource management. The human environmental approach to river-basin management was introduced in the recent years. Since the 1990s, human systems are seen as a vital part of natural resource management and the notion of social-ecological systems were established (Chakraborty; 2007). Organizing water management inside physical-ecologic boundaries of river basins or catchment areas is a principal challenge of IWRM. The declaration of landscape as a unit area of political action has led to an amendment in political thinking and action in a new spatial context. The modern spatial policy contrasts previous water management policies that conformed to regional administrative borders and were based primarily on hierarchical leadership (Kasbohm et. al; 2009).

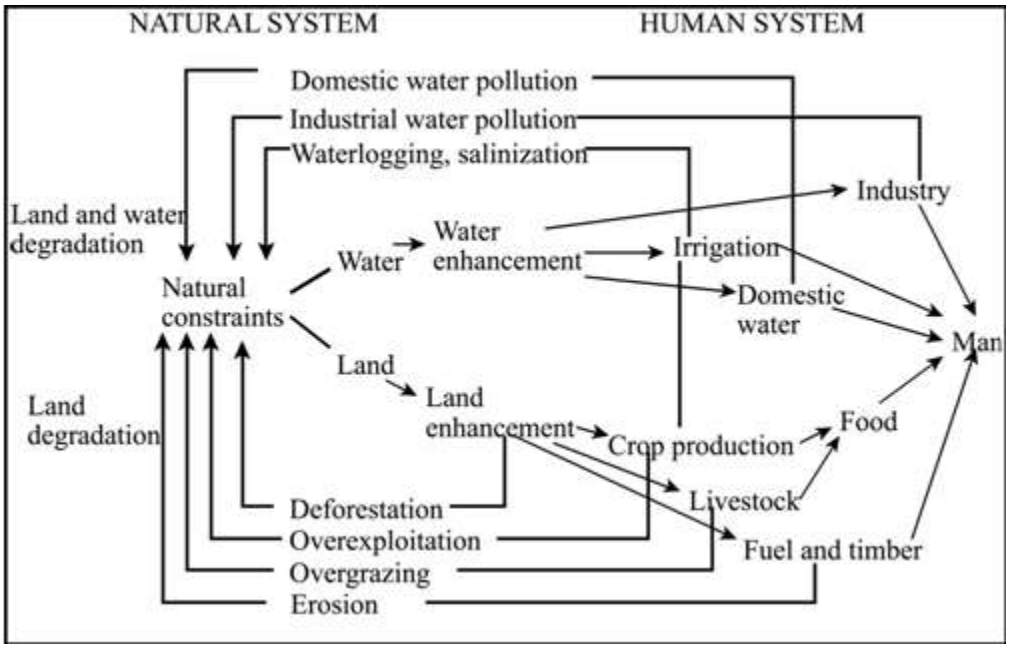
Integration must to combine two main components:

- The natural system, which is essential for determining the accessibility and quality of the resource,
- The human system, which regulates the exploitation of the resource, emergence of waste and resource pollution and develops and controls the related infrastructure.

Integration though the natural system is, for example, integration of land and water management, surface and ground water, and upriver and downriver water issues considering the whole hydrologic cycle.

Integration within the human system is a cross-sector matter relating to stakeholders' decision-making process. To guarantee coordination of water management offers among those responsible for water sectors and along the whole water basins, developing official mechanisms and plans of cooperation and information exchange is essential (see Figure 6).

Figure 6- The integration of resources and feedback between human and natural systems

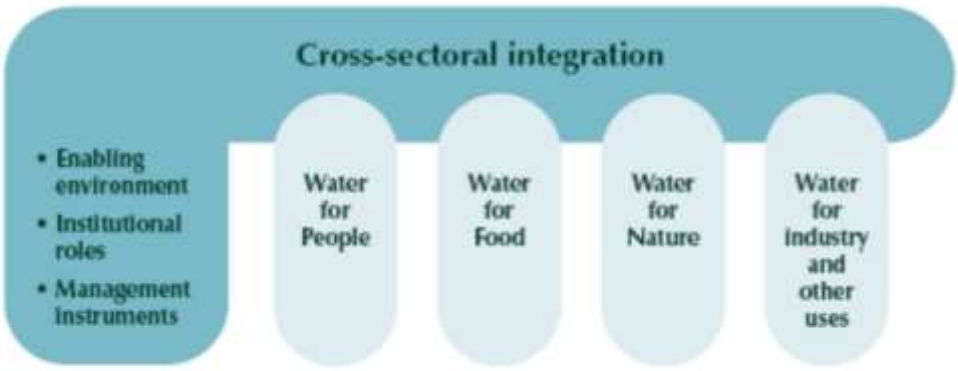


Source: Falkenmark; 1986.

The coordination mechanisms and plans should be built at the premier political level and conveyed to other involved levels of water management.

Furthermore, the IWRM must support and provide uniformity with ongoing governmental policies and national or sectorial development plans and/or funds. Therefore, understanding the relationship between IWRM and plans and processes at both national and sectorial levels (see Figure 7) and considering these in the planning is important (GWP; 2004).

Figure 7- Cross-sectoral integration



Source: GWP 2000.

3.3.2. Patterns of integration in IWRM

Integration means that different usages of water resources are considered in managing those resources. In management, this integration ensures the formulation of homogeneous water policies among all sectors and is the opposite of individual sectoral water policies that obscure cooperation and coordination.

The sustainable use of water resources requires overriding traditional methods, so holistically balances competing demands in various sectors and available resources. According to Sibai (2013), Kasbohm et. al; (2009) and GWP (2000), the theory of IWRM involves the integration patterns discussed in the following sections.

3.3.2.1. Integration of the quality and quantity of water resources

Where the integration is seen from different perspectives:

- Water allocation requires one to consider the appropriate water quality for each water use. For example, supplying drinkable fresh water for cooling machinery in factories is not acceptable.
- An environmental impact results from using water for irrigation or industrial purposes. This impact is usually reflected in the pollution of existing fresh water and the gradual deterioration of water quality. For example, in irrigation projects, the water mixed with fertilizers and pesticides cause groundwater pollution and a gradual rise in ground water levels.
- The management of industrial wastewater contribute to the contamination of groundwater and surface water resources. This potential environmental impact must be considered when planning any project and should be attached to the project report.

3.3.2.2. Integration between surface and ground water

Usually, surface water and the upper aquifer are hydraulically connected so that any human activity on one positively or negatively affects the other. This interaction must always be present and properly evaluated when planning any water project.

For example, implementing a project needing to pump a large amount of groundwater will lead to a reduction of water level and loss of hydraulic inclination toward the surface waterway. These losses will thus reduce the nutrient levels of the watercourse, especially in the summer periods and probably will cause their complete depletion. Also, pumping groundwater causes a decline in the discharge of watercourse feeder springs.

Furthermore, dam construction in upper waterways reduces the amount of surface water in down waterways, leading to losses in groundwater recharge.

3.3.2.3. Integrating the interests of the upper watercourses

For example, discharging untreated wastewater in upstream areas affects water use in downstream areas whether for irrigation or otherwise. The change in land use upstream affects the groundwater recharge and the seasonal runoff for the watercourse. The upstream flood control facilities affects may dependent on the flood life down the river.

Over-consumption of water in higher watercourse areas reduces the users' share the lowest watercourses areas.

This relationship is evident in the shared international rivers that originate from neighbouring countries and flowing into or through Syria.

Thus, agreements are necessary to control the use of these resources and fairly and equitably divide them. The control of shared water resources applies to groundwater resources too, although accurately estimating quantities of groundwater flow is difficult.

Shared aquifers may be subject to depletion or pollution due to exploitation in areas of nutrition. Furthermore, shared aquifers between the states need to have agreed strategies and policies for their optimal exploitation through mathematical modelling.

Any water policy must consider users at the downstream areas when starting a project in upstream areas. To facilitate this, an organizational administrative management structure of river basins must be established to control and adjust the use of water in the entire basin. Moreover, this management structure should include representatives of water users. This body

may exist within the same country or include representatives from riparian countries with the authority to enable them to optimally manage the basin.

3.3.2.4. Integration between land management and water

The distribution and quality of water are affected by type of vegetation and form of land use.

The conversion of agricultural land to residential, for example, increases the runoff in the basin and reduces its time of concentration, which causes unprecedented flooding in addition to the negative impact on water quality due to the disposal problems of wastewater resulting from household uses.

In addition, the conversion of forest land to cultivated areas changes the shape and system of water use and increases the pollution risks because of fertilizers and pesticides. Furthermore, this conversion may also lead to raising the groundwater levels, especially in the absence of an adequate drainage system.

Integration allows the planner to estimate and evaluate the potential effects of changing land use and mitigate its negative implications.

3.3.2.5. Integration among different sectors in the national policy plans

The IWRM must include all water-related development projects since there is a mutual effect between water policies and various sectoral policies, which depend on water.

For example, the nutritional policy may have an impact on water resources in terms of changing agricultural crops and needed irrigation water amounts. The water policy may have a social or economic impact on water users (like migration or more water pumping costs to lower groundwater levels). The sharing of information and data among different sectors and the coordination of their water-related activities is essential for reducing the impact of national policy on the water resources. In addition, a specific mechanism to assess the project's impact on water resources must be set.

The decision support system is considered important information that helps decision makers to assess the different effects of a region’s development policies.

Thus, water-related issues in all economic and social sectors should be considered within the overall management of resources, which requires the integration of economic water policies as well as the various sectoral policies.

3.3.2.6. Integration of all users in planning and decision-making

User participation in the planning and management of water resources is globally acknowledged as necessary to achieve a balanced and sustainable use of water resources. However, there is often competition and conflict among users of limited water resources.

To deal with these circumstances, the integrated management system must develop practical tools to resolve conflicts and mechanism to assess the interests and the goals of planning process and compromise to find solutions.

3.3.2.7. Integration of water management and waste management

Water is a renewable resource and a reusable one. Various uses of water lead to the production of low-quality wastewater. Improper management of this water will inevitably lead to the pollution and increasing the pressure on of fresh water. Proper management includes the treatment of waste before its disposal according to permitted standard specifications.

To encourage proper management, incentives must be secured to reuse treated water and deterrent penalties must be implemented for those who refrain from treating the water.

Support for industrial development does not mean polluting waterways with industrial wastewater, and agricultural development does not mean ignoring poor irrigation and wastewater management (Sibai; 2013; in Arabic), (Kasbohm et al; 2009) and (GWP; 2000).

The Five-Year Plan of Syria has paid increasing attention to the construction of wastewater treatment plants to secure an additional water supply and protect fresh water resources. All countries in the Arab region are seeking to increase the benefits of using of this resource: the estimated annual amount of wastewater reached 10.8 km^3/year of which 55% was treated and 15% was reused after treatment in agriculture and irrigation industry.

Finally, the methodological application of management should be adapted to each country and region based on geographical and environmental characteristics, institutional and administrative systems, economic development priorities, and cultural values. Although the concept and principles of IWRM strategies are common, its application strategies and tools vary according to prevailing conditions even within the same region.

The integration in management is the science and art of cooperation which seeks to blend the interests and objectives of the different sectors to draw a sound strategy for the management of water resources.

The integration itself is not sufficient to achieve sound management, but it is undoubtedly a prerequisite.

3.3.3. The principles of IWRM (Dublin principles)

The concept of IWRM emerged entirely during the World Conference on Water and the Environment (ICWE), which was took place in Dublin, Ireland in 1992. This conference was attended by 500 participants representatives of 100 nations and 80 global and non-governmental societies. The conference resulted in the adoption of four principles, which are a guide for water resources management. Furthermore, IWRM was considered a necessary tool for the practical application of basic principles and recognizes the overlap between economic, social, and environmental security.

Subsequently, the outlined principles were combined with the recommendation of Agenda 21, which stemmed from the Conference on Environment and Development in Rio de Janeiro. Afterwards, these principles have powerfully influenced the emergence of IWRM, and their role has been defined (Xie; 2006).

The application of these principles requires an integrated method in expansion, management, and usage of water to achieve social development, economic efficiency, and environmental sustainability with the participation of all water using sectors.

Therefore, significant changes for the advancement of water institutions were introduced and the frames of water institutions, terms of reference were adjusted, and the legal framework was modernized to cope with IWRM concepts. Furthermore, the effective mechanisms for coordination between the institutional bodies concerned with water were established and the principle of participation in the preparation of plans, programs and its development, implementation and follow-up were activated.

3.3.3.1 The first principle

‘Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment’ (ICWE; 1992).

Since water means life, functional management of water resources requires a universal approach, connecting social and economic progress with safeguarding of natural environments. Functional management should consider the link between land and water uses across the entire catchment zone or groundwater layers.

Water is essential in all aspects of human life, including health and social and economic development.

The increase in population, the demand for water, and the pollution and deterioration of the fineness and amount of all water resource has all made fresh water less available. However, this resource is limited in nature because the quantity of water on the earth is fixed and moves continuously within the water cycle.

Therefore, there is no increase in the amount of water available. Development must occur for limited and available water resources (such as non-conventional water resources and seawater desalination).

Hence, the effective administration of water must achieve a balance between the use of resources for life and development and the protection of resources to conserve their usages and features.

3.3.3.2 The second principle: the application of the participatory approach

'Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels.' (ICWE; 1992).

Public participation is an important element of IWRM and is grounded on the theory of deliberative democracy, which challenges the top models in decision making in communal policy and the inter-relation between public, private, and representative associations (Ker Rault; 2008).

The concept of IWRM was expanded to encompass the participatory approach in decision-making. The different users (farmers, environmentalists, communities) can influence the development and management of water resources strategies to create additional benefits. Users can more effectively apply a system of local self-control to water conservation and protection of the water basin than the centralized system, and surveillance can be installed (Cap-Net; 2010). In the application of IWRM, a partnership approach can be considered the most influential factor in the effective implementation and formulation of sustainable strategies.

The management of water resources is the responsibility of everyone that the cooperative approach does not automatically arise, but it requires the presence of appropriate institutional and legal frameworks, which stimulate and control the pattern and the effectiveness of the participation.

In addition, water management calls for a governmental decision to adopt the mechanism of partnership. However, time, effort, and negotiating capabilities may be required to reach solutions that satisfy all or most stakeholders.

Due to its specificity, the theory of public participation is discussed in detail later in this thesis.

3.3.3.3 The third principle: women's involvement

'Women play a central part in the provision, management and safeguarding of water.' (ICWE; 1992).

The vital role of women as suppliers and users of water has been rarely considered in organized measures related to the management and development of water resources. Therefore, the recognition and application of this principle requires programmes dealing with the special necessities of women and their empowerment and preparation to contribute at all levels in water resources plans, including decision-making and application (Jusi; 2013). The ideology of IWRM highlights the role of women in water resources management. Recognizing the role of rural population and actively support this role is necessary since women's involvement will increase project effectiveness, support environmental sustainability, enhance social and economic analyses, and reduce imbalances between genders.

3.3.3.4 The fourth principle: the economic value of water

'Water has an economic value in all its competing uses and should be recognized as an economic good.' (ICWE; 1992).

Water has an economic value in all its usages and should be seen as a valuable resource. The first elementary right of all human beings to access to save water at a reasonable cost because the previous failures in managing the economic value of water led to wasteful uses of this resource and destruction of the environment. Managing water as an economic good is an important way to achieve its effective and fair use and to encourage dialogue for the protection of water resources (ICWE; 1992). The IWRM was built on a basic concept that the water is an integrated element of the ecosystem and is a natural resource and a social and economic good (Snellen & Schrevel; 2004). Therefore, we should not only focus on the development of water resources, but also manage these resources to ensure their long-term and sustainable use for future generations.

3.3.4. The implementation of IWRM

Water's multiple uses should be coordinated. Multi-users of the limited water resources are tied to each other and depend on each other. For example, the rising demand for water for irrigation leads to contamination of agricultural drainage water, resulting from more cultivation of agricultural land. This situation leads to a smaller share of fresh water for drinking and industry

sectors, which leads to high levels of pollutants in sewage and industrial water, threatening rivers and ecosystems.

The Integrated Water Resources Management (IWRM) is concerned with considering all water uses. When deciding the allocation of water among the water using sectors, management should account for the impacts of each use on the other uses.

Therefore, the integrated management considers all the strategic, economic, and social objectives, including sustainable development.

A method of cross-sectorial policy, IWRM is designed to replace traditional fractured and fragmented water resources management method, which led to poor water services and irrational use of water resources.

According to the United Nations' guidelines on the application of IWRM (2012), the implementation of IWRM executes three basic pillars:

- Enabling an environment of sustainable water resources development and management, including proper policies, plans, and legislation,
- Establishing the institutional framework by which the policies, plans, and legislation can act,
- Preparing the necessary management instruments for these institutions to conduct their tasks (UN Water Report; 2012).

According to the study of German Development Institute (GDI), for the implementation of IWRM, decentralized, participatory, and demand-oriented approaches are essential since they enhance the consensus and understanding of sustainable management and decision-making in water management (GDI; 2000). According to Hübschen (2011), IWRM is based on the subsidiarity principle, which allows decisions regarding non-national interests (such as local water allocation, supervision, licenses and sanction, and conflict resolution) to be shifted to a local level.

The principles of IWRM defined throughout the International Conference of Water and Environment in Dublin include the following (see Figure 8):

- The conversion from water supply into water demand management,
- The consideration of water as an economic good,

- The involvement of the general public, especially women, in solving the problems related to water sector (Hübschen; 2011).

Figure 8- Main principles of IWRM

Source: Hübschen; 2011.

In the following sections, the principles of demand management, decentralization, subsidiarity, participation, and privatization or PPPs, as important modes of decentralization, are generally defined. Then, their relationships to the water sector are discussed.

3.3.4.1. Demand management

Water demand management (WDM) is defined as:

> The adaption and implementation of a strategy by a water institution or consumer to influence the water demand and usage of water in order to meet any of the following objectives: economic efficiency, social development, social equity, environmental protection, sustainability of water supply and services, and political acceptability (Jalil and Njiru; et. al; 2006; P: 234).

The Forum on Water Demand Management in the Mediterranean Region, held in Fiuggi, Italy, in October 2002, provided a more sophisticated and comprehensive working definition of WDM.

According to Salman and Mualla:

If water demand consists in the sum of water use (use and losses), Water demand management consists in the body of interventions and organization systems that societies and their governments can apply to rise technical, economic, public, organizational and ecological

efficiency in water management. Complementary to supply-side policies (development of new water sources and supply facilities), Water Demand Management, therefore, tries to reduce physical and economic loss and better satisfy economic, social and environmental demands. Its implementation relies on a host of tools (economic, technical, institutional and the mobilization of stakeholders) that it is advisable to adapt to each situation (Salman and Mualla; 2008; P: 550).

Water demand management (WDM) specifically aims to reduce the water losses and water misuse (intra-sector efficiency). In addition, WDM assures reasonable allocation between the various users and optimizes water use (cross-sectoral efficiency) considering the supply needs of steam-flow processes, resource conservation, renewal and quality, and the development of various uses of water. Furthermore, WDM provides additional value to mobilized resources units and reduces the pressure on financial and natural resources, limiting unsustainable exploitation of both renewable and non-renewable resources (GWP; 2012). Therefore, considering water as an economic resource or commodity is the goal of WDM to increase water use efficiency[5] and expect people to find a balance between water supply and water demand. The purpose of WDM is the following:

- Motivate the national economy, industrial sectors, and water resources to provide modifications to their structures, quantity, and spatial distribution,
- Raise public awareness of water uses and water resources to achieve rational water consumption and reduce revenue costs,
- Introduce water saving technologies and advanced wastewater treatment technologies and plants, where the benefits of water conservation and water reuse are shared between the water sector and water users (Da-ping; et. al; 2011).

Classification of water demand

Water uses are categorized into groups according to different criteria. For instance, water use can be divided into residential, commercial, industrial, agricultural, hydropower, recreational, and environmental. Water uses are also divided into two main categories, depending on their impact on the hydrologic cycle: consumptive and non-consumptive (Xiao; 2017). The assessment of allocated water quantity is closely related to the consumptive and non-consumptive classification of water. Consumptively used water deteriorates the source and is

[5] Water use efficiency refers to any measure that decreases the quantity of water used per unit of any given action, consistent with the conservation or improvement of water quality (Hamdy; 2007).

not available for other uses, while non-consumptive water use does not negatively affect the source or hinder upcoming water use (Adelsman; 1991).

The three main types of consumptive uses are municipal, industrial, and agricultural. Municipal water generally is the water used for residential, commercial, and public facilities, as well as some small industries connected to the main water supply system in the city. Residential use, also called household or domestic use, refers to water uses within houses, like toilets, showers, cooking facilities, and washing machines, as well as washing cars and watering gardens. Water demand in this sector is determined by population density, income level, climate conditions, and cost of water supply (Baumann et. al; 1997).

Water can be used in the industry for various purposes, such as for part of final product, cleaning, flushing, sterilizing, conveying, or cooling, and for personal needs. The type of industry and technological processes are the main determinants of the total water demand.

Water is consumed mainly in agricultural sector by irrigation and livestock needs. The water can also be supplied from the local distribution system. The required amount for irrigating plants depend on their species, growth, method of irrigation, type of soil, and climatic conditions. There are a number of methods in literature to calculate the crop water requirement based on meteorological data (Blaney Criddle, Penman, etc) (Trifunovic; 2006).

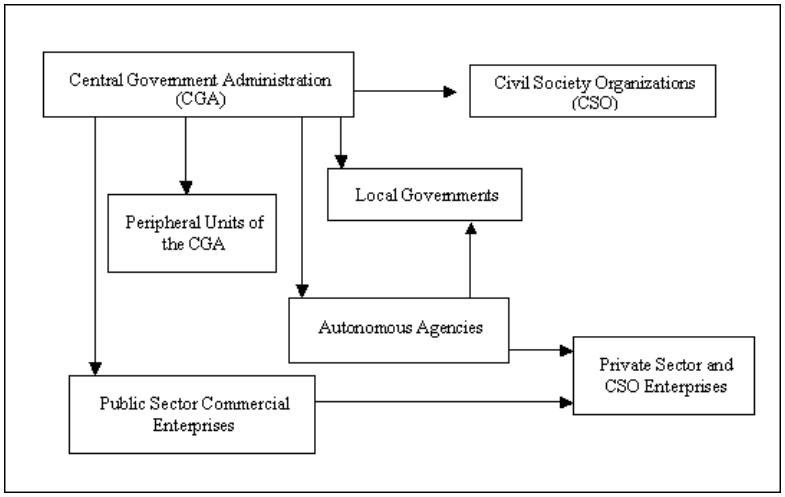
3.3.4.2. Decentralization and subsidiarity

Decentralization was identified by Rondinelli (1983) as 'the transfer of responsibility for planning, management, and resource rising and allocation from the central government to:

- Field units of central government ministries of agencies,
- Subordinate units or levels of government,
- Semi-autonomous public authorities or corporations,
- Area-wide regional or functional authorities, or
- nongovernmental private or voluntary organization' (Rondinelli et. al; 1983; P: 13).

Decentralization emphases the organisation and the process of decision making and of the allocation of the resources and distribution of duties between different levels of government. This concept also focuses on the relationship between three main sectors of governance: public, private, and voluntary.

Figure 9- Decentralization of responsibility from the central government



Source: FAO; 2001.

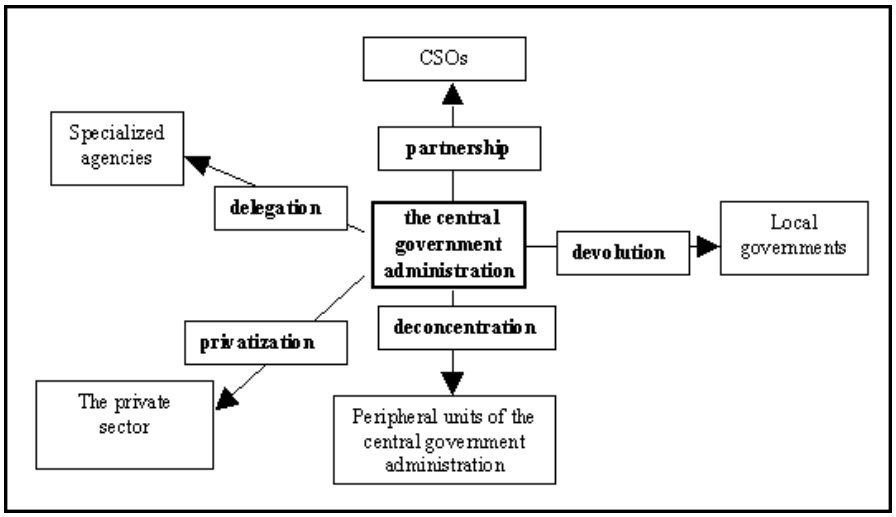
The central government administration is characterized by a hierarchical governance system, where the flow of instructions, commands, and resources is up-down from the higher level units to the subordinate level units. Thus, the track of command is top-down, and the track of responsibility is bottom-up.

The local government is a unit of public administration that has a non-hierarchical dependence on the central governments' administration and has the authority to autonomously manage public functions (FAO; 2001).

The civil society organization (CSO) is an important part of countries' system of governance. This organization is also non-state and people follow shared benefits in the public sphere, such as community establishments and rural associations, eco-friendly groups, women's right assemblies, farmers` assemblies, religious organizations, labour unifications, co-operatives, specialized unions (UNDP; 2007).

According to the information delivered by the Center for International Earth Science Information Network (CIESIN), decentralization aims to transfer the responsibilities for the organisation and controlling of definite public sectors from the primary government to local units of government organisations, subservient ranks of supervision, semi-independent communal bodies, or companies. The redistribution of power, accountability, and finances for public service provisions among different levels of administration are the main goals of decentralization (CIESIN; 1997-2019). The major forms of decentralization are deconcentration, delegation, devolution, partnership, and privatization (Figure 10).

Figure 10- Five forms of decentralization



Source: FAO, 2001.

According to Cheema and Rondinelli (2006), since the expansion of governance, decentralization has begun to not only include the transfer of power, authority, and responsibility within governments but also shape the public policy within society by share authority and resources. The expanding concept of governance decentralization varieties can be classified into four forms:

- Administrative decentralization refers to deconcentration of central administration authority and responsibility of semi-autonomous agents of the state.
- Political decentralization includes organizations and measures to enhance civilian involvement in choosing political representatives and creating communal policy. This form also addresses reforming the government structure through the delegation of powers and control to local units of government. Furthermore, political decentralization refers to power sharing institutes through federalism within the state and institutes encouraging independence of association and membership of public society organization in public policymaking, influencing political decision making through mobilizing social and financial resources,
- Fiscal decentralization involves tools and instruments for financial cooperation in division of public incomes among all levels of administration, such as municipal revenue raising and expenditure distribution through fiscal delegation, fiscal independence for state, regional, and local governments,
- Economic decentralization includes liberalization of market, deregulation, privatization of state institutions, and PPPs (Cheema and Rondinelli; 2006).

Decentralization can play an important role in expanding participation in political, economic, and social activities in developing countries but only under suitable circumstances, leading to the following:

- Alleviation of the obstacles in decision making initiated by central organization,
- Improvement to the control of important economic and public events,
- Reduction in the bureaucracy procedures and increased government sensibility to local needs,
- Improved service delivery to local areas,
- Larger political representation for different social groups,
- Enhanced opportunity for local residents' participation in decision making.

However, decentralization may have the following potential disadvantages:

- Not always efficient for services that depend on standards, routine, and network,
- Potential loss of financial resources and control over limited resources by the central administration,
- Low service efficiency caused by insufficient administrative or technical capacity at the local level,
- Complex coordination of national policy captured functions by local elites,
- Undermined cooperation between public and private sector due to distrust (CIESIN; 1997-2019).

The theory and practice of decentralization have incorporated subsidiarity, which is considered as a main normative principle for federation and multinational organizations. The literature review of this principle stated the Catholic social theory in the mid-20th century developed the principle of subsidiarity, which became integrated into the political, economic and general concepts of central administration. Subsidiarity draws attention to central government, individuals, and the inter-positioning structures against governmental supremacy. The principle implies that taxing, payments, and regulatory tasks should be executed by subordinate levels of the government unless the central government can make a convincing case for nominating itself for these tasks. Arguments for keeping power should be made based on comparative efficiency (Ryan and Woods; 2015). According to Riescher (2001), subsidiarity is a socio-ethical, constitutional, and socio-political principle, which states that matters, following the criteria of necessity and ability for accomplishment, should be handled by the lowest specialized entity (Riescher, et. al; 2001).

For water management, decentralization of water resources was applied in developing countries to overcome the burden of central government bodies (and financial issues) and authorize local societies. The results of decentralization in developed countries or countries with libertarian institutional structures were positively estimated. However, the developing countries could not achieve consistent results due to the absence of responsive and well-financed organizations which are able to regulate water quality at localized levels. In many cases, the responsibilities for critical government services were transferred, according to the principle of subsidiarity, to institutions and societies that required capacity to efficiently manage water resources. In many examples , the application of the principle of subsidiarity was unwarrantedly accelerated, bearing in mind that managing water resources should happen at the local level, when actually, institutional capabilities indicate that local institutions are not the proper governance level (Stoa; 2014). The practical application of the IWRM approach to developing water policies and the decentralization process still faces many challenges. The main challenges are reflected in the lack of transparency in power relations and the distribution of competences between central and local institutions and between old and newly established organizations, the lack of financial sustainability of the managing agencies and budgets; the lack of capacity building and human personal skills for managing water at various institutional and geographical scales; increasing conflict potential due to the broader decision-making power given to local actors with colliding interests; the unclear role of the government in the activities of local water forums, users associations, and agencies; difficulties related to public-private relations and power delegation to private actors to manage water resources; lack of reliable data and information for effective decision-making processes; cultural obstacles concerning water pricing for O&M; and investment costs recovery for water services (Mutondo et. al; 2016).

The decentralization of responsibilities from top to lower levels or other groups from communities or the private sector has led to poor governance due to the lack of political willpower at the higher level. This willpower would that ensure the efficient implementation of decentralization measures, making people with different viewpoints work together and increasing awareness and capacity building for people involved in basin decisions (GWP; 2003).

3.3.4.3. Public and citizens' participation

3.3.4.3.1 The objectives of public participation

Public participation is expanding in its use around the world with different specialists and academics from various scientific branches. The International Association for Impact

Assessment (IAIA) prepared a panel of guidelines to improve and coordinate public participation in impact assessment and to stimulate the discussion between stakeholders to ensure the best application and accomplishment of the following public participation objectives:

- Promoting justice, equity, and collaboration by inviting the interested public into the decision-making process,
- Informing and educating all the concerned supporters, community decision makers and the supervisor on the intended involvement and its effects,
- Collecting material about the community`s human (traditional, societal, economic, and administrative) dimensions and the surrounding ecosystem, as well as about the inter-relationships between stakeholders and their environment,
- Seeking feedback from the community on the intended interference's scale, timing and methods to minimize the destructive effects and maximize its positive products or to reimburse for effects that may be not alleviated,
- Achieving additional innovative development, more ecological interventions, and accordingly larger public appreciation and support through better analysis of proposals,
- Influencing the mutual learning of the public and improve public participation in impact assessment to generate new proposals (IAIA; 2006).

3.3.4.3.2. Definition of public participation

Public participation is the general public's involvement in development projects. There are many definitions of public participation.

Ramphele defines public participation a means for the general public to control social, political, economic, and environmental factors that influence their daily lives through gains in skills, knowledge, and organizational capacity (Ramphele; 1990). In addition, the IAIA defines public participation as 'the involvement of individuals and groups that are positively or negatively affected by, or that are interested in, a proposed project, program, plan or policy that is subject to a decision-making process' (IAIA; 2006; P: 1).

According to Arnstein (1969), public participation is a means to redistribute power that enables the lower-class stakeholders who are not joining political and economic processes to be involved in the future (Arnstein; 1969). Creighton defines public participation as 'the process by which public concerns, needs and values are incorporated into government and assist decision making. It is two way communication and interaction, with overall goal of better decisions that are supported by the public'. Although definitions of public participation vary, at least three of the following elements are included in each definition:

- Public participation is related to administrative decisions, which are mainly made by companies and/or by private establishments, not by hired employees or juries,
- The interaction between decision-making authorities and people during the process of information exchange is of great importance,
- Public participation does not happen accidently or coincidently; the process should be well organized,
- The stakeholders are able to influence the decision-making process at a certain level (Creighton; 2005).

Thus, effective participation is only possible when the following three pillars are in place:

I- The right of information, which is the obligation of decision-making authorities to confirm people's easy access to relevant information to guarantee their meaningful participation,

II- The right to participate in decision-making procedures implies the people cannot be involved in a decision-making process by only providing the relevant facts to them. There should be a set of appropriate mechanisms, and the public must be informed at an early phase of the participation process, including the relevant period of time.

III- The right to justice means the public must have access to the responsible court and or judiciary to contest or discuss decisions that may affected their rights (UN/ ECE; 2001).

Principle 10 of the Rio Declaration on Environment and Development, approved by 178 governments in 1992, states the following: 'Environmental issues are best handled with participation of all concerned citizens at the relevant level' (Rio; 1992; P: 2).

The United Nations` human rights treaties, the International Covenant on Civil and Political Rights, affirms the 'freedom to seek, receive and impact informations' (article 19) (OHCHR; 1966). One of the most important human right instruments targeting participation is General Comment 15 (2002:48) on the application of Articles 11 and 12 of the International Covenant on Economic, Social and Cultural Rights (1966), which indicates the following:

> The formulation and implementation of national water strategies and plans of action should respect, inter alia, the principles of non-discrimination and people's participation. The right of individuals and groups to participate in decision-making processes that may affect their exercise of the right to water must be an integral part of any policy, programme or strategy concerning water. Individuals and groups should be

given full and equal access to information concerning water, water services and the environment, held by public authorities or third parties (CESCR; 2003; P: 15).

Public participation, after the collapse of the Iron Curtain, was identified by the governments across Europe[6] as one of the seven strategic components of the long-term ecological programme of Europe.[7] The approval of the Aarhus Convention in 1998, particularly for East Europe, the Caucasus and Central Asia.

The Aarhus Convention (1998) represents a unique development in public participation by the UN Economic Commission for Europe through the disposal of any UN member state (with approval of the parties; article (19 (3)). This development is assigned specially to participatory rights.

The convention provides, without discrimination of nationality or residence, the ability to access environmental information gathered by public authorities (art. 4); an early stage public involvement in ecological decision-making (art. 6-8), and the right to contest in court public decisions taken in breach of environmental laws, especially the right to access data and public participation in decision-making (art. 9) (Aarhus; 1998).

These regulations support public participation in preparing plans and programmes on water resources management and would be helpful to combat the challenges to management or application of decisions for water resources (Razzaque; 2009).

3.3.4.3.3. Advantages and disadvantages of public participation

Although public participation has several benefits, many practitioners and stakeholders were disappointed when these claims could not be realized. Public participation has many advantages according to Reed (2008) and Creighton (2005), including the following:

- Improved quality of decision making due to the consultation process with the public and clarifying the needs and goals of a project or policy,
- Maintained credibility and legitimacy by improving the quality and durability of decisions. The public members will be more willing to accept a decision they could influence,
- Promotion of active participation through the inclusion of more stakeholder in decision making,

[6] For the purpose of this publication, pan-Europe is understood to include the 56 States members of the United Nations Economic Commission for Europe and the 53 States in the WHO European region.
[7] At the Second Ministerial Conference 'Environment for Europe' in Lucerne, Switzerland, in April 1993 (see: www.unece.org/env/efe/historyofefe/history.en2011_2. Html.

- Increased public trust in decisions and civil society by targeting a transparent participation, which considers conflicting claims and views,
- Stakeholder empowerment through the co-generation of information with academics to benefit from this knowledge
- Enhanced long-term support and implementation of decision making through the increase sense of ownership by a broad coalition of stakeholders (Reed, 2008; Creighton, 2005)

Furthermore, public participation will enhance the information exchange between civil society and the authority by reflecting the needs of the public and ensuring a higher level of accountability (UN; 2013).

However, the potential advantages are sometimes debated. According to Wouters et. al; (2008), public participation can be expensive and time consuming, and its effective application needs capacity building and a trained staff within the related organization. Poor application of public participation could end up losing confidence in the agency, for example. Stakeholders may not participate again if they had a negative experience of the process in addition to adverse perceptions of the outcomes. Wouters et. al; (2008) and Botes & Van Rensburg (2000) consider that community participation must concentrate on the social and power relations between the stakeholders in a development planning process. A lack of negotiation about resource allocation between the various groups leads to circular decision making, frequent changes in decision makers, and failure to develop existing legal frameworks (Wouters et. al, 2008; Botes & Van Rensburg, 2000).

Indeed, most authors consider that public participation has more advantages than disadvantages (Irvin & Stransbury, 2004; Marzuki, 2015) since many achievements were realized in the public participation process regardless of the problems that may appear in the approaches, administrative procedures and passive attitude of the stakeholders.

To achieve the maximum benefit from public participation, core values, which aim to enhance the best practice approaches and objectives of public participation, are recommended.

3.3.4.3.4. Core values of public participation process

According to the standards of International Association of Public Participation (IAP2), the most successful and respected values of public participation are the following:

- The stakeholders affected by decision making have the right to participate in the decision-making procedure,

- The stakeholder' contribution influences the decision,
- Sustainable decisions are enhanced through an awareness of the requirements and interests of all participating groups and decision makers through the active communication,
- Those affected by the decision are included in the decision-making procedure, provided with important information, and informed how their input affected the decision (IAP2; 2007).

3.3.4.3.5. Public participation in water management

Local participation is an essential part of planning that should be strengthened since water quality and quantity are directly connected to the land use (Matthwes; 2001).

Water sector management forms an appropriate institutional framework that helps encourage participation at the local level or at the level of the water-basin management. Furthermore, participation facilitates decision making at all levels and in the creation and development of policies and operational plans, as well as in the management and implementation of outreach programs and the rationalization of consumption at the local level.

To develop a partnership, the first step is identifying stakeholders and determining their role to the management of water resources. The next step is clarifying the important choices in drawing mechanism of the partnership, which should be discussed seriously with the stakeholders and focus on the following points:

- Participation capabilities and empowerment,
- Expansion of the base of participation,
- Consensus formation.

The concerned authorities in the management of water resources and their roles needs to be clearly specified for avoiding the overlapping and the communication and coordination between these authorities and stakeholders should be monitored and promoted.

The methods and programmes for raising awareness for different groups should be used to raise awareness on national and local levels. Furthermore, the current and prospective investors (NGOs and the local authority) should play their role in various projects to develop water services of the local community and its institutions. The participation needs appropriate framework for the exchange of opinions and dialogue among local participants at the countrywide and local levels, periodic meetings and workshops between workers and users, and legal and institutional tools available to resolve conflicts. (Abed Rabbouh; 2013; in Arabic).

There are several methods for implementing stakeholder participation. Each method is characterized by own objectives, strengths, and weaknesses (see Table 1). According to Kessler (2004), the purpose of participation determines the choice of participatory method, which include building consciousness, enhancing agency decisions, creating recognition of agency activities, increasing confidence, and empowering stakeholders (Kessler; 2004).

Table 1- . Features of selected participatory methods

Method	Objectives	Strengths	Weaknesses
Focus group discussion	Obtain information; problem identification; for learning between different stakeholder groups, between experts and other stakeholders	Rapid; cost effective; adaptable; reach group consensus; flexible means of assessing information from public	Information based on few people; less structured; requires effective facilitation so not to lose focus
Citizen juries	Reach consensus; obtain recommendations; have democratic decision-making process	Deliberative; promote open and constructive dialogues	Decision making by few people; outcome may depend on social and psychological group factors
Workshops	Share planning and decision-making responsibilities; development of skills of stakeholders	Improve decision-making process; empowers	Outcome may depend on social and psychological group factors
Interactive web page	Involve a broader segment of the population; announce meetings; for consultation; for open response on significant issue	Important when quantity rather than quality of data is needed; reaches the younger generation; efficient flow of information	Only people with knowledge in IT & are computer literate with access to internet can participate; it is expensive
Consultation document	Obtain views and opinions on significant issue	Improved decision-making	Requires literate participants
Public hearings, Open forum/public meeting	Obtain public testimony or comment	Inexpensive way of disseminating information to a large number of people	Can be dull or confrontational; insufficient deliberation; intimidate the uneducated & verbally unskilled; ownership not encouraged; may be dominated by unrepresentative groups
Demonstration	Show a viewpoint	Stakeholders may have a voice to impact on decision	Conflict may develop
Media, leaflets, brochures, pamphlets, posters	Inform, create awareness	Involve a broader segment of the population	Expensive

Source: Anokye; 2013; P: 74.

The participatory approach requires an increased consciousness of the significance of water among decision makers and the broad public. The decisions should be prepared at the lowermost proper level in addition to integrating users into the planning and implementation of the water projects (Butterworth et. al; 2006). The fragmented framework in water management cannot solve the interlocking relationships between the various sectors that have been identified in Dublin. The majority of specialists in the field are running the process of water use on a sectorial basis, without coordination among plans and works and without dealing with environmental associations or administrative boundaries.

Moreover, the most affected partners are local people whose lives heavily rely on rational water management but are not involved in the decision-making practice.

Thus, the participation of all partners interested in water strengthens collective opinion and ensure transparency and democracy in decision making and implementing plans (good governance). The interested partners might be the private sector, professionals, academics, local groups, non-governmental organizations, or individuals who cannot be involved in all stages of the public participation, starting from providing information and consultation to participating in the planning, execution, and observing of the process and the evaluation of the results.

The first step in developing an approach to activate partnership is identifying the stakeholders and how they can add to the management of the water resources. The next step is to clarify important options in establishing a partnership mechanism, which needs to be discussed with stakeholders and focused on the following points.

Participation must be real:

Real participation occurs when the parties involved become fraction of the decision-making process, which can arise right when local people converge to determine the options for water supply, management, and use.

Participation occurs when the stakeholder groups are presented with elected organizations, agencies, or spokespersons or through local governments and community-based organizations or water user associations. The type of participation depends on the local conditions for water management, where the decision-making occurs.

A consensus must be obtained:

The method of participation is the only way to attain a long-term agreement, and this matter requires that participants recognize that resource sustainability is a public issue and all parties concerned have to sacrifice some of their desires for the public interest.

Participation means taking responsibility and recognizing the impact of each sector on the other, as well as a sector's impact on aquatic ecosystems.

We should accept the need for change to develop water use efficiency and promote the development of the resource in a sustainable way. Since public involvement in water management does not always achieve agreement, methods of negotiation or other mechanisms to resolve controversies should be applied.

Mechanisms to raise the participation capacity:

The issue is not only the act of participation but also the ability to participate in decision making. Despite the importance of creating consultative mechanisms, this importance does not guarantee real participation. The national and local governments should bear responsibility for developing the concerned parties' potential for participation.

Raising participation capacity requires creating mechanisms to consult shareholders on all spatial levels (basin, province, and municipal) and realizing the participation of all concerned classes including raising awareness, building confidence and education, finding an economic resources to facilitate participation, and securing accurate and transparent sources of information.

Participation can be used to achieve an appropriate balance between the lowest and highest levels of the pyramid (from top to bottom and from bottom to top) for the IWRM. The most interested and affected partner are the local people, whose lives rely heavily on the rational management of water and appropriate decisions. Thus, water resource management at the level of a house or a farm might be correct (GWP, 2000; Hack; et. al, 2014).

3.3.4.4. Public-private participations (PPPs)

Public-private participations have gained popularity in public sector management. Since the 1980s, privatization, market mechanisms, competitiveness in the distribution of communal goods and services, deregulation, and reformation of the role of government became the key words of New Public Management (NPM). Shifting the focus from public service to service delivery, NPM insists on reducing expenditures in public sector, delegating tasks to private sector and promoting non-obligatory involvement of the private sector to provide public goods (Mitchell-Weaver; et. al; 2013). The establishment of PPPs as a new management tool was encouraged by the principles of NPM, and at present, PPPs have become a favourite tool to provide services and develop societies in many countries worldwide. According to Hodge and Greve (2007); 'PPPs is understood as 'cooperative institutional arrangements between public and private sector actors' (Hodge and Greve et al; 2007; P: 12).

3.3.4.4.1. The cooperation between public and private necessary:

The United Nation´s Development Programme identified the limitation of the national and local governments' financial resources for expanding services and creating infrastructure projects and the poor allocation of the national budget to municipalities and agencies (UNDP; 2000). The privatization of many goods, like transportation, telecommunication, water pipeline-

systems, and electricity, increases the efficiency of service delivery (Roth; 1987). Verger and Moschettil (2017) state NPM considers the following criteria when adopting PPPs:

- Must increase the level of economic resources dedicated to public services and provide higher value of money,
- Must allow the private sector to be responsible of service delivery where the governments oversee planning, policy, quality assurance, and program improvement,
- Must increase the potential for innovation by concentrating on the results rather than on the process,
- Must enable governments to avoid limitations (especially those related to union organizations, restrictive employment regulations, and old-fashioned governmental pay scales),
- Must target innovative and efficiency gains through applying competitive pressure on the provision of service (Verger & Moschetti1; 2017).

According to Siddiqui (2015), the establishment of PPPs to manage the previous public sector´s responsibility has several advantages for both the citizens and the governments. First, PPPs can expand competition and service provision efficiency and minimize the cost of delivery. Furthermore, the private sector can manage the complete supply series more efficiently than governmental organisations. In addition, PPPs can generate creative ideas, designing plans and projects, and develop collaboration between design and production facilities. Moreover, PPPs can avoid costly design of public assets and concentrate on project life costs to start construction of new buildings and facilities. The government can lower the costs, benefiting from using private capital from the private sector. Finally, PPPs can avoid the bureaucracy that dominates the national and local governments and experiment new technology (Siddiqui et. al; 2015).

There are many definitions of PPPs since these definitions are characterized by diverse features and involved in different activities (Khanum; 2010). These definitions seek to delimit the field of PPPs.

Linder defined the term broadly as ‘rubric for cooperative ventures between the state and private business’ (Linder, 1999, et. al; Schomaker, 2008; P: 44).

The advisory group in public building PPPs provides another broad definition:

> the long term, contractually regulated cooperation between public and private sector, in which the necessary resources (e.g. know-how, resources, capital, personnel, etc.) of the partners for mutual benefits in a common organizational context adjusted and existing

project risks appropriate according to the risk management competence of the project partners (PPP; 2003; P:1).

Antoni Verger and Mauro Moschettil define PPPs as 'arrangements between public and private actors for the delivery of goods, services and/or facilities.' (Verger& Moschettil; 2017; P: 2).

Each definition reflects selected PPPs features and different authors' different understandings of this notion, thus illustrating the disagreement in the literature on the nature of PPPs. However, these definitions are all designed for the concept of national cooperation between public and private sectors in one project with mutual benefits for both parties.

Public Private Partnerships (PPPs) stand for a modern, future-oriented form of cooperation between public and private partners. Therefore, PPPs enjoy great popularity with politicians and stakeholders. This popularity has accelerated the development of PPPs in recent years. Meanwhile, the term is widely used to describe traditional self-administration to full privatization, making it arbitrary and unstructured. According to Kühlmann (2006), the basic idea of PPPs is becoming increasingly obsolete. However, they are generally are characterized by the following:

- Teamwork between the public and private sector,
- Participation in different service areas,
- Voluntary cooperation,
- Long-term cooperation (20-30 years),
- Superiority of partners,
- Public service providers (Kühlmann; 2006).

According to Bovarid (2004); the reasons behind the orientation towards PPPs in many countries are mainly the financial problems of the governments and the need to assemble private capitals for the provision of public services. Furthermore, the governments started to cooperate with private organizations in the Information and Communication Technology sector (ICT) for gaining access to investments in large-scaled projects, and to benefit from the expertise of private companies (Bovarid; 2004). Even though, the transparency is closely related to PPPs and exists at all stages of project implementation less transparency can occur while executing PPPs contracts for communal infrastructure building, and by involving the private sector in public policy. The limitations of transparency are related to national security measures, governments' core interests protection, and keeping the secrecy by private and commercial companies as important basis for private markets that act to reward or punish Innovation in business decision making (Greve et. al; 2011). The general term PPPs has a wide diversity in

meaning that we should be aware of. The understanding and the function of PPPs can differ not only between countries and between management systems, but within a particular country. The role of PPPs will remain essential for the public sector, especially with more consideration of public governance concerns (Bovarid; 2004).

3.3.4.4.2 Forms of cooperation between public and private sectors

The provision of services for developing infrastructure and advanced economies is increasingly outsourced by the government. Governments frequently use contracting as a method to advance private sector contribution in providing communal services and establishment of public facilities. Cooperation through contracting for infrastructure and services permits governments to organize services or facilities with the private sector companies according to the governmental specifications. The three mechanisms through which the government generally contracts with private organization are service, management, and leasing arrangements (Rondienelli; 2002).

According to Budäus (2006) and Schuppert (2007), there are three main generations of cooperation patterns between public and private sectors according to the motives of cooperation for both sides. The first generation of PPPs is characterized by task cooperation, within which the specific practical knowledge of both partners is combined. The second generation of PPPs, according to this argument, emerged from the necessity of involving the private-partner sector due to financial shortages in the public sector. The third generation of partnerships was induced by the private sector itself. The motivation behind this generation is the assumption of public responsibility-cooperate social responsibility, which chooses to take over private enterprise to enhance its position in the society (Budaüs, Schupert; et.al, Schomaker; 2010).

The following models for implementing PPPs projects were identified by the most literature on PPPs: service contracts, operation and management, leases, concessions, build-operate-transfer (BOT) contracts, and variants.

3.3.4.4.2.1. Service contract

Under this legally binding arrangement, an authorized government agency conclude a contract with a private company for providing definite non-core services within infrastructure systems. Competitive bidding is usually offered for these contracts, which are short term (a few months or two years). The public authority is in charge securing the general service, as well as the capital investment. This type of contracting with PPPs is advisable in areas with strong political or public opposition to broader contribution of PPPs or when the government seeks to place responsibility for non-core functions (Turina & Car-Pušić; 2004).

3.3.4.4.2.2. Management contract

The United Nation`s Economic and Social Commission for Asia and Pacific (ESCAP) defines the management contract as 'a contractual arrangement for the management of a part or whole of a public enterprise by the private sector'.

A management contract can permit private sector expertise to be transferred into service and distribution, operational regulation, employment administration, and equipment purchasing. Under such contracts, possession of the unit and obligation for the service delivery remain with the government. The responsibilities of private sector are limited to specific services and do not have to consider commercial risks. A private contractor is paid for service provision in accordance with work performance. The duration of the contract is relatively short, from two to five years (ESCAP; 2008).

3.3.4.4.2.3. Lease contract

The Public-Private-Partnership Legal Resource Centre (PPPLRC), provided by World Bank Group, considers lease contracts as a public private sector arrangement under which the private company is obliged only to operate and maintain the utility. Financing the project is a matter for public sector.

This kind of contracting is suitable in specific circumstances:

- Ownership rights of private sector and commercial debit are not presented for water supply and sanitation;
- Good combination of public financing and private efficiency is targeted by awarding authority;
- Commercial risk should by passed to the private sector with incentives to perform other than through the management contract (PPPLRC; 2016).

3.3.4.4.2.4. Concession

Under this PPPs arrangement, the private partner have the responsibility for all services, including operation, maintenance, rehabilitation, and renewal of properties and spreading out of service. The contract usually lasts from 20 to 30 years, and by the end, project ownership reverts to the public authority. The private investor is paid by consumers for its service according to a set fee or tariff in the contract for recovering the investment costs and making a reasonable profit. Concessions are an attractive option for PPPs involvement and allow full responsibility of operation, maintenance, rehabilitation, renewal, and service expansion. However, it requires strict monitoring and enforcement due to long-term monopoly (Turina and Car-Pušić; 2004).

3.3.4.4.2.5. Build-operate-transfer (BOT) contracts and variants

Build-operate-transfer has additional variations, such as build-transfer-operate, build-rehabilitate-operate-transfer, and build-lease-transfer arrangements. The private partner (concessionaire) is in charge of investment and facility operations for a period after which the public sector can regain ownership of this facility. The risks related to operation and investment can be basically shifted to the private sector (ESCAP; 2008).

However, the necessary investment in existing facilities is much lower in the context of PPPs than in the construction of new facilities using the BOT model. This approach allows the private partner to better estimate necessary investments and provides the public partner with prestige. To prevent this misallocation, more attempts are being made to promote models for the maintenance and expansion of facilities. As the example of the International Finance cooperation indicates, models involving the construction of new facilities will be subsidized correspondingly lower to provide appropriate incentives for the concerned private companies (Schomaker; 2010).

3.3.4.4.3. Challenges for PPPs

According to Romero (2015), the evidence of PPPs efficiency is not convincing because generally the efficiency depends on the sector and the nature and scale of project.
The contract is between public and private sectors and the regulatory framework and the governance system in the country in which the project occurs. The expansion of PPPs can be difficult. The best application mechanisms and their structures should be carefully considered when making PPPs work. The evidence from unsuccessful PPPs experiences indicates that they can have negative consequences. Thus, PPPs have to overcome the following challenges:

- Developing the potential to afford PPP options compared to public procurement,
- The level of efficiency in delivering services that contains fair comprehensive risk assessment,
- Assessing the sustainable developing impacts of poverty reduction and fighting against inequity,
- Creating democratic systems for negotiations, administration, and monitoring the project, which include considerations of transparency and accountability mechanisms (Romero; 2015).

3.3.4.4.4. Main components of an enabling institutional framework for PPPs

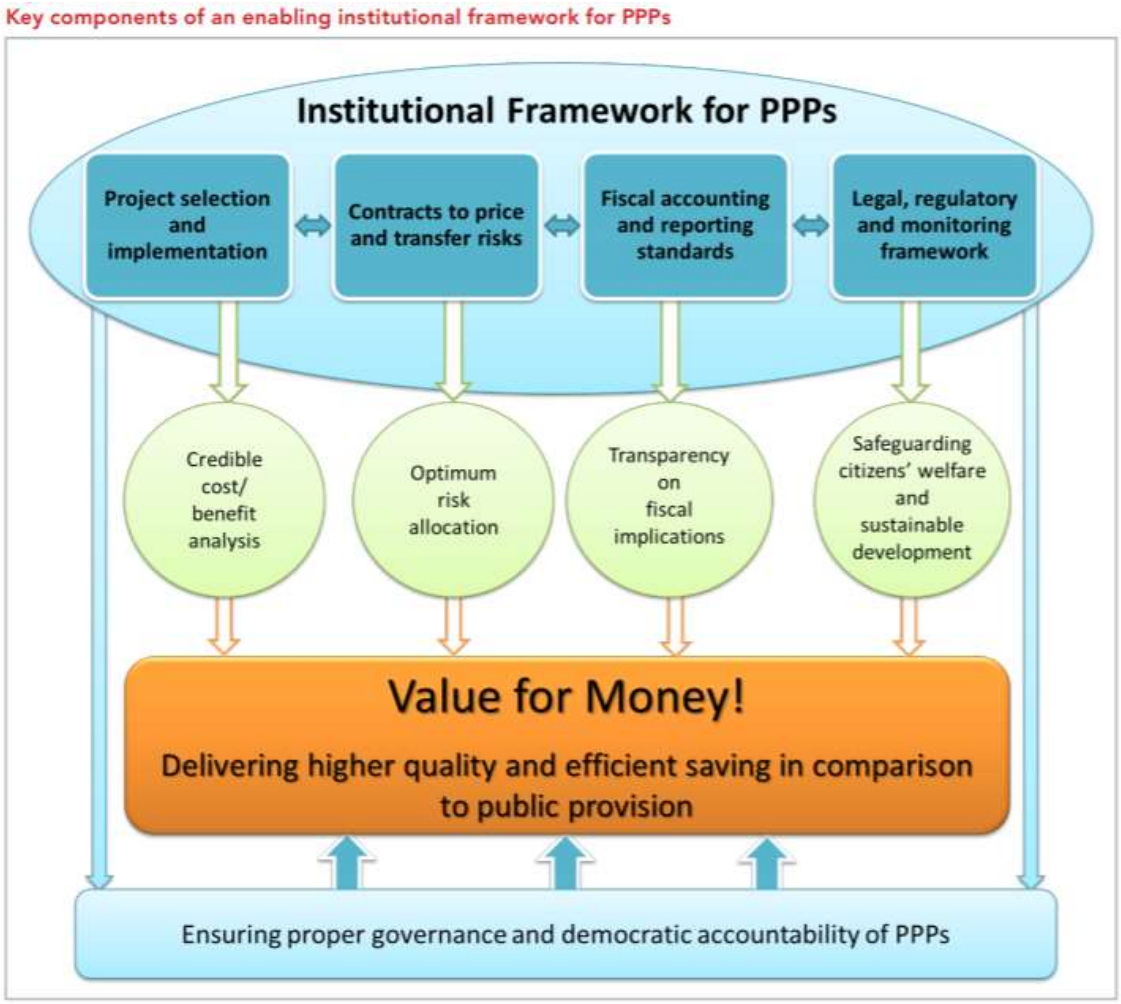
The evidence indicates that PPPs in the sector of economic infrastructure was not always an absolute success. Their effectiveness depends on a number of interrelated conditions, which could be key elements within a broader institutional framework.

To increase the effectiveness of PPPs in service delivery, efficiency, and development impact over services provided by public sector, public sector must be able to do the following:

- Rationally detect and choose projects where PPPs would be applicable,
- Formulate contracts to guarantee adequate pricing and shift of threats to private sector,
- Set inclusive and transparent monetary accounting and transfer and recording standards for PPPs,
- Create legal, regulatory, and monitoring frameworks that guarantee service quality and appropriate standards.

In other words, countries need to obtain the institutional capacity to produce, manage, assess and observe PPPs (see Figure 11) (Jomo et.al, 2016).

Figure 11- Key components of an enabling institutional framework for PPPs.



Source: Jomo et. al; 2016.

3.3.4.4.5. PPPs and regulation in the water sector

Using the economic methodology to analyse the specifics of water sector are sometimes accompanied with high run feelings when they used by economists. Water is often referred to as a basic need of life that should not fall into the hands of profit-oriented companies. However, humans' dependence on water in all every regard makes economists obliged to speak on this essential issue. One company's ability to supply the entire demand in market at a lower cost than two or more other companies is called a *natural monopoly* because the increase in a company's production leads to low average cost of one unit produced. This interrelation is clear in a network industry, such as the water sector. From the economic point of view, providing a second pipeline system near and existing one is not logical. Therefore, one company can supply the whole demand at a lower cost than one or more companies with individual networks.

Finally, a private water supply company will gain a monopoly in a specific area and might misuse this power to keep water price high to maximise its profit. Thus, consumer needs would be ignored since the water provider and the infrastructure would lack maintenance, which can affect the water quality. Consumer protection from monopoly power should be considered regarding the problematic nature of water sector (Oelmann & Czichy; 2013).

3.3.4.4.6 Risks of PPPs in the water sector

Previous experiences with international and national privatizations in the water sector have detected a number of disadvantages of PPPs.

According to Kappel and Schmid (2007), these disadvantages include the following:

- Privatization makes water more expensive (e.g., prices in France and England were 20% higher than in Germany),
- Lack of water supply occurs during privatization (e.g., in London)
- After privatization of 80% of the water sector, citizens in France could not turn to the town hall, where they have their decision-makers. They were dealing with an unknown group whose representative was not accessible to the citizens,
- Private monopolies have emerged, as the experiences of other countries illustrate,
- Private companies do not have sufficient incentives to keep the network in acceptable condition, which can lead to health problems and water loss (Kappel and Schmid; 2007).

According to Rothenberger (2003), the EU correspondingly played a key role in deregulation. In the EU Communication 'Services of General Interest' (Commission 2001), the EU Commission argues that liberalization of various areas of services of general interest secures and increases quality and consumer protection. The debate over whether the liberalization of urban water management is promoted by the EU has not yet been concluded. In November 2002, the EU Internal Market Commissioner pleaded for the liberalization of the water market when the discussion had calmed down in Germany and the 'modernization' of the sector was prominent. However, this leading to an opening of the retail markets with transit/shared network use, as in the energy sector, is also unlikely in the European discussion (Rothenberger; 2003). The approach of liberalization unfortunately does not suit the nature of the water supply sector due to its specific characteristics. The European Commission approved these differences in the characteristics of the national water supply markets in 2004 and abstained from issuing an EU-wide directive concerning the water sector. This decision was made according to the subsidiarity principle, which means the least centralized authority still able to address the matter effectively is responsible for handling this issue. For Europe, the responsibility of water services

are taken by national governments in some countries and by municipalities by others (Oelmann and Czichy; 2013).

3.4. Challenges of IWRM

There are significant challenges of the soft systems of IWRM that need to be encountered (Ohlson; 1999), such as unclear margins and compound connections; complications with goals, alternatives and consequences; penetrating uncertainty; and various users conflicts.

These challenges can be divided into three categories:

1) Complexity: the amount of needed information is increasing through the growing number of components and interactions we intend to describe.
2) Subjectivity: the evidence we receive is sometimes full of values, which can be unreal or connected to interests, making it essential to balance things in contradiction of each other.
3) Uncertainty: the cap between the amounts of information we need to conduct our tasks and the available information (Galbraith; 1973).

The essential elements for IWRM should be identified to help policy makers gain clear understanding of water-related issues. The Technical Advisory Committee GWP has mentioned other critical challenges:

- Water issues still have limited awareness and low priority at the political level;
- The domination of the centralized beliefs, with supply oriented management and disjointed sub-sectoral tactics to water management, in the institutions,
- The local government has a low level of capacity for building in the field of water management;
- Failed cost recovery and inadequate pricing structures are causing incompetent functioning and repairs of water systems, as well as irrational water allocation and water loss;
- Low-level investment in the water sector are due to ignorance in the national budgeting procedures;
- There is lack of data and information to support sound management of water;
- Economic, social, and ecological standards are inappropriate for the authorization of plans and projects (GWP; 2000).

Therefore, the IWRM plans need a good water governance system since it is a political process. A series of dialogues on ‘Effective Water Governance’ and the lessons have been presented at the third world water Forum in Kyoto (2003).

The Global Water Partnership identified water governance as 'the range of political, social, economic and administrative system that are in place develop and manage water resources, and the delivery of water services, at different level of society'.

Improving the effectiveness of water governance requires the following:

- Creating an enabling environment that facilitating public and private sector initiatives;
- Establishing a legal structure with a strong independent guiding administration;
- Achieving a clear transaction between stakeholders in an environment of trust that shares accountability for the protection of water resources (GWP; 2003).

According to the multi-level approach of the Organization for Economic Cooperation and Development, water governance is the political, institutional, and administrative framework for IWRM. To overcome the multi-level governance challenges in the preparation of water policy, we need to consider the preliminary guidelines for integrated public governance of the water policy:

- Analyse multi-level governance in water policy creation across state authorities and public organisations and between levels of government and national subordinate branches,
- Encourage sub-national government in the planning of the water policy, parallel to their role as 'implementers' and assign human and economic resources in line with tasks of governmental bodies
- Enhance inter-institutional cooperation across ministries and public organisations by adopting horizontal governance strategies to strengthen coherence across water-related policy areas,
- Construct, apprise, and harmonize water database systems to share water policy requirements at water-basin, countrywide, and international levels.
- Assess and screen the outcomes of water policies at all levels of government and afford motivations for professional training by encouraging the performance measurement.
- Encourage coordination across sub-national actors as a response to the fragmentation of water policy at the local level.
- Promote the professional training at all levels of government. Including the combination of investment in water purification and wastewater treatment, or 'hard' infrastructure, and 'soft' infrastructure (i.e., mainly the organisations on which water results are based and their capability to perform their assignment in an efficient and coordinated manner).

- Development an open and distinctive policy to water policy making through public membership in water policy design and execution.
- Evaluate the appropriateness of present governance mechanisms to address recognized challenges and facilitate co-ordination of the water policy at horizontal and vertical levels (OECD; 2011).

Many countries' socio-economic development policies and systems do not comply with the basic principles of IWRM. Stakeholder participation and decentralization are essential when involving people in decision-making processes regarding water resources management and planning.

Most planning tools, such as management approaches and human, institutional, and methodical capabilities to meet the local demand for ecological water facilities under climate change conditions are missing. Trans-boundary and provincial water questions add difficulty to the development of adequate national resources in water resource management (Kasyap; 2004). The development from state-cantered actor to non-state and state actor is the decentralization process, which reallocates authority and capital resources to facilitate the involvement of various stakeholders in the governance of a countries' natural resources. Two important subjects in implementing IWRM in countries' policies are decentralization, rather than centralization, and public participation in decision making (Uhlendahl et.al; 2011).

4. The framework conditions and challenges of water resources in the Syrian Arab Republic

4.1. Overall country overview: political system, geography and climate

Syria has formed the centre of many civilizations since ancient ages. The capital of Syria is Damascus. Modern Syria gained its independence in 1946, and Syria has been ruled by the Arab Socialist Baath Party since 1963. Officially the political system is a unitary multiparty republic with one legislative body, the People`s Assembly (Fanack; 2019).

According to Kout (2008), Syria is situated along the eastern coast of the Mediterranean Sea. The climate in Syria is generally characterized by a cold, rainy winter and hot, dry summer. The main three climatic zones are the following:

- Coastal area with a moderate rainy climate,
- Mountainous area with rains and a moderate climate,
- Interior zone characterized by water scarcity (Kout; 2008).

The Mediterranean climate is dominant on the coast and the western mountains. There is almost no rainfall from May to October. The medium temperature is 32 ºC, but it is cooler in the mountains. The winters reach temperatures around 10 ºC. The inland region, part of the vast Arab Desert, has more continental climate, with hotter summers and colder winters. Snow and frost are common in the winter (Fanack; 2019).

4.2. Water Resources and water infrastructure in Syria

The hydrological studies of water resources have divided the territory of Syria into seven major water basins: Badia basin, Euphrates basin, Orontes basin, Barada and Awag basin, Tigris and Khabour basin, Yarmouk basin, and Costal basin.

In addition to the surface water, which has been exploited in the main basins in Syria , there is certain potential for additional storage through dams. The quantity of dams exceeds 150 with total storage capacity of about 18 billion m^3. The storage capacity of the largest dam, Al-Tabka dam in the Euphrates-Aleppo basin, is 14.16 billion m^3. The total storage capacity of the dams in the Orontes Basin (more than 40 dams) is one billion m^3. The agricultural sector is using the major share of stored water and some dams are built in the Steppe basin for livestock water supply (Kaisi at. el; 2007).

4.2.1. The availability of water resources for different uses and its relationship to climate and water demand

Most of the Middle East and North African (MENA) countries have arid to semi-arid climatic conditions. These countries are characterized by variety in rainfall, surface water, and ground water (Salman & Mualla; 2004).

The natural water resources, as a part of the hydrologic cycle, are related to the amount of precipitation and its components. Moreover, water distribution is related to the runoff coefficients and the recharge of the ground layers within the limits of the local basin and in the neighbouring basins.

The amount of available water resources depends on the degree of regulation of surface and ground water resources, which are determined by infrastructure facilities for storage, withdrawal, transport, and distribution of water, the financial and technical abilities of control and the availability of observation and monitoring systems for water quality and quantity. The value of this regulation in Syria is between 60% in Badia basin and 98% in Euphrates basin.

The level of renewal of water resources varies according to the possibility of its periodical compensation from its different sources within a specific period.

The water resources are seasonally renewable when their compensation accrues in one hydrological year, moderately renewable when compensated through a period of 7 to 16 years, low renewable when the period of compensation reaches hundreds of years, and are fossil groundwater when the necessary compensation time reaches tens of thousands of years or geological epochs.

The results of the data analysis related to the traditional renewable water resources for 1959 to 2010 year indicated change inside the Syrian Arab Republic in the range of 5.622 to 16.188 Milliard M^3/year (Daoud; 2013; in Arabic).

According to the valid and signed agreements and protocols with the riparian states.

The surface water resources in Syria emerge from the surface water bodies flowing in the main seven water basins, including the international rivers, like Euphrates, Tigris, Yarmuk, and Orontes.

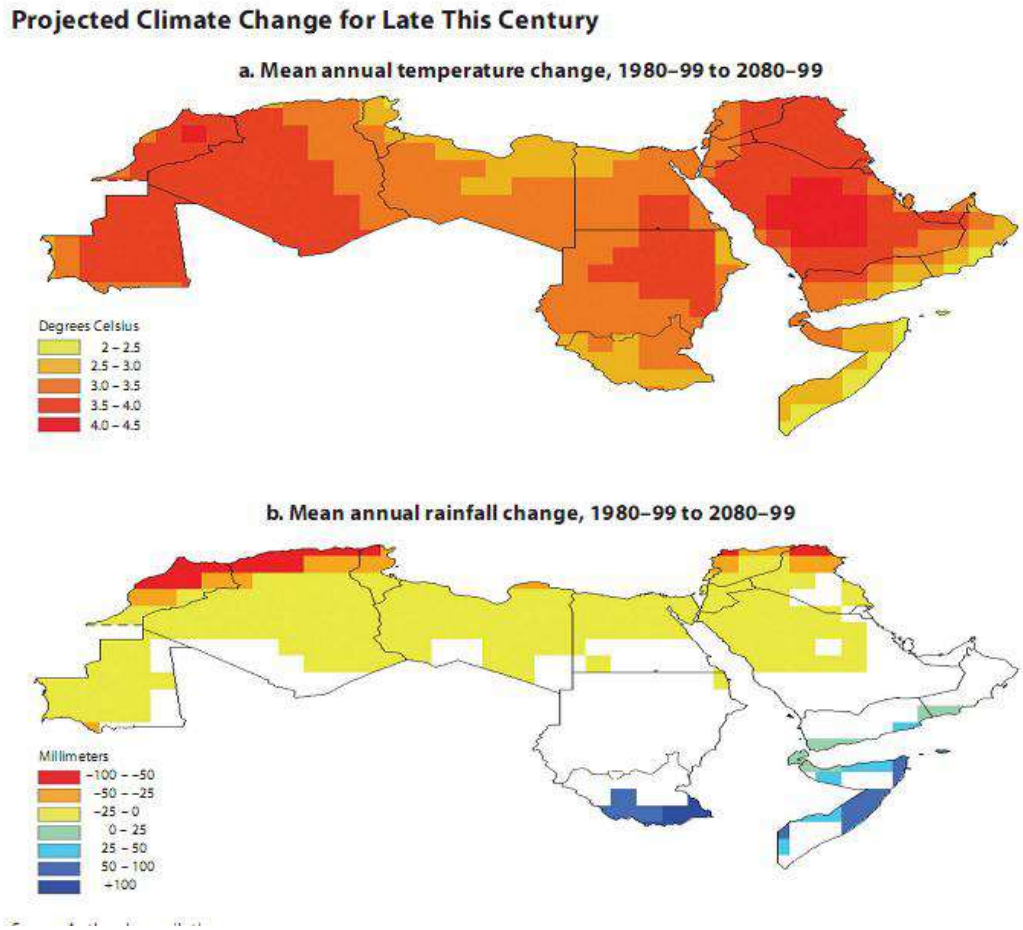
The groundwater resources are distributed mainly in the sedimentary layers of the third and fourth modern eras in riverbeds and in the deeper layers of the Cretaceous age as the hydrogeological map of Syria indicates.

The water resources are used from both sources to meet the demand for water for various purposes. Despite the significant expansion in the reliance on surface water resources, due to widely expanded storage and distribution systems, however, the ground water in some areas constitutes the only source of water supply. The high dependence on ground water resources is not only associated with seasonal surface water resources, but rather with the absence of control over the quantity and quality of withdrawn groundwater, which led to the emergence of improper exploitation of all water resources.

According to the Initial National Communication Report (2010), climate changes play a central role in defining the values of the elements of the hydrological cycle and the variability of their quantity. Consequently, the qualitative impact of various natural contaminants results from these changes and from the vital activities, especially those of humans.

The problem is becoming more complicated as climate change in the Middle East and the Arab region is now threatening a continuous decrease in the volumes of available renewable water resources. While the extent of the effect of climate change resulting from global warming and the greenhouse gases have not been definitively determined, the forecasting indicates a tendency toward drought for the entire Eastern Mediterranean area. In addition, the results of studies and regional and national research suggests a high probability of decreasing amounts of water resources (INC; 2010) as a result of a decrease in the quantities of rainfall and expected high temperatures (figure 12). These decreases constitute another challenge for planners and water policymakers (Verner; 2012).

Figure 12- 'Decline in amounts of rainfall and high temperatures expected for the period 2028-2090 compared with the period 1980- 1999.'.



Source: Verner; 2012.

The World Bank (2007) presents water scarcity in the MENA region. This scarcity plays a role in slowing social and economic development in countries and even leads to conflicts within the region (Ibisch & Borchardt; 2009).

Moreover, because of the intense competition among water consuming sectors for the limited water resources, the amount of available water for a particular user is decreasing by the increase of these uses by any water using side. In addition, the rapidly increasing demand for water from all economic sectors, caused by population growth and social and economic development, leads to a decrease in quality and amount of the available water resources for various uses.

4.3. The water governance and water sector structure in Syria

4.3.1 Political system and institutional framework in Syria

The societies of the MENA region are characterized by extreme centrality of policymaking and governance (Schomaker; 2010).

4.3.2. Governance indicators

Researchers and scholars have many definitions of governance. The World Bank defined governance in 2002 as 'Rules, enforcement mechanisms and organizations'. In 1992, focused on the public sector management issues, the World Bank defined governance as 'the manner in which power is exercised in the management of countries' economic and social resources for development' (IFAD; 1999; P:1).

Daniel Kaufmann defined the concept of governance as

> the tradition and institutions by which authority in a country is exercised. This includes (a) the process by which governments are selected, monitored and replaced; (b) the capacity of the government to effectively formulate and implement sound policies; and (c) the respect of citizens and the state for the institutions that govern economic and social interactions among them. Accompanied by Governance Indicators (Kaufmann; 2010; P: 3).

According to Schomaker (2010), the six dimensions of governance are:

-Voice and accountability determines the degree to which citizens can co-decide on the election of the government, as well as the degree of independence of expression, meeting, and media.

-Political stability and absence of violence determines the prospect of political instability, of unconstitutional violent change of power, and of political violence and terrorism.

-Government effectiveness determines public services' quality and their freedom from governmental intervention, the excellence of policy design and enactment, and the reliability of politicians who have committed to policies.

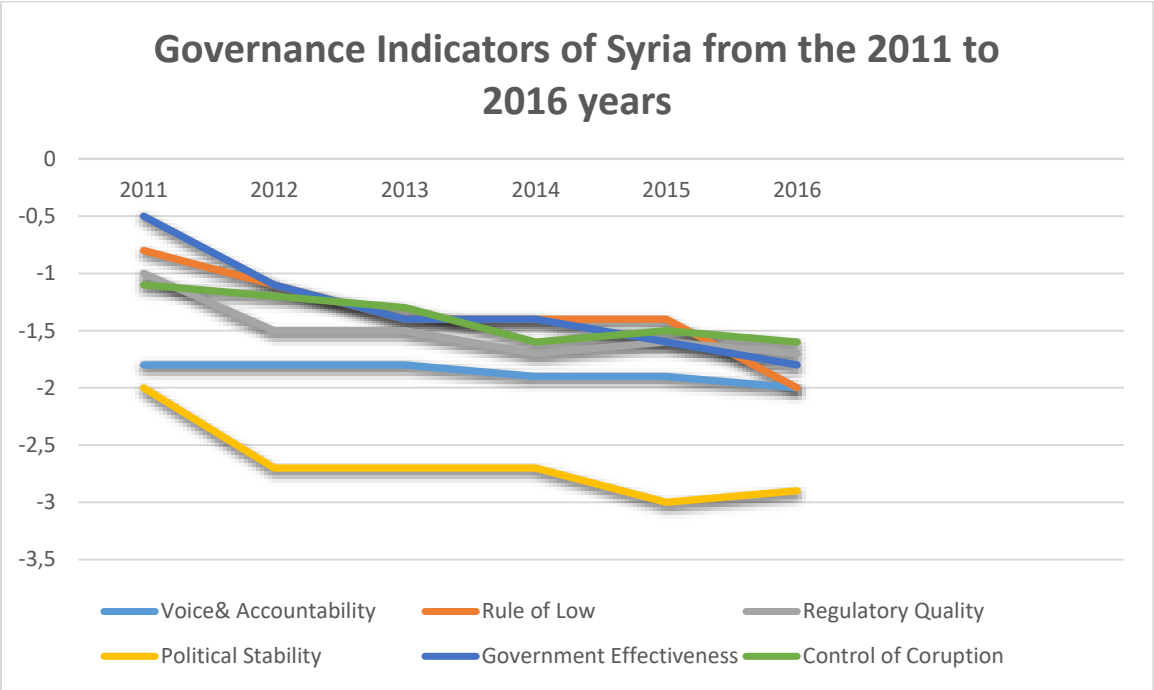
-Regulatory quality defines the government's ability to shape and perform policies and rules that allow and encourage private sector involvement.

-Rule of law determines the degree to which executives, such as government and bureaucracy, trust and obey social laws, particularly the quality of contract enforcement, the protection of possessions rights, the quality of the police force and judges, and the probability of crime and violence.

-Control of corruption describes the degree to which government and bureaucracy are vulnerable to corruption and the extent to which elites and political party interests can influence the state (Schomaker; 2010).

Away from the discussion about of reliability of methodology of the worldwide governance indicators in gathering the data, the World Banks' estimations of these indicators in Syria reflect an extremely low values, which continued to decrease during the Syrian crisis (see Figure 13).

Figure 13- Governance indicators of Syria.



Source: Own Representation. Data Source: World Bank Data Base**.**

The water sector is a part of the comprehensive social, economic, and political structure and is thus affected by outside judgements.

United Nation's definition of water governance refers to 'the political, social, economic, and administrative systems that influence water's use and management'. Essentially, the definition outlines who receives what water, when and how, and who has the authority to water and associated services and their profits.

Governing water involves the creation, establishing, and execution of water strategies, regulation, and organizations and interpretation of responsibilities and roles of administration, public and private sector regarding water resources and services. The results are subject to how the water users perform in relation to the instructions and their assigned roles (UNDP; 2016).

The deficits in the regulatory framework for integrated water resources in Syria are clear. There is no appropriate mechanisms for the enforcement of the old water laws, like prohibition of well drilling and ground water pollution. The Syrian water sector is characterized by a great level of

centralization and fragmentation between institutions of different sectors that have overlapping roles and tasks (SWIM-SM; 2012).

4.3.3. Institutions in charge of the water sector in Syria

The water sector includes the available water resources and the services performed by the government through a number of specialized ministries. According to Kaisi (2007), the water legislation of Syria was formulated according to Law no. /31/ in 2005 in coordination with responsible ministries and other concerned ministries. The water legislation was developed in line with a water resources strategy and sustainability principle in accordance with Syrian status. The water policies and management practices, as well as enforcement, are expressed in this water legislation.

The implementation of water legislation desires the development of demand-based water plans proper for water policies (short-, mid-, and long-term), providing institutional changes in accordance with legislation's content and adopting key technical procedures according to decision made by the highest committee, the Higher Water Committee, governing the use of national water resources (Kaisi et. al; 2007). The water sector includes the available water resources and services, which are performed by the government through a number of specialized ministries. A comprehensive water management framework does not exist in the Syrian water legislation system (Aqua-stat; 2016). Water legislation in Syria is characterized by a high degree of centralization of decision-making. There is also a fundamental problem with considering agriculture as the main income resource of the country, and consequently, its huge consumption of water must not be criticized (Elhadj; 2004).

The state planning commission is the head coordinator of the water sector (see Figure 14 below). According to Salman and Mualla (2004), about 140 laws were made in the last 70 years addressing water and its utilities (Salman and Mualla; 2004). Over the last 30 years, the government has made new decisions mainly concerning the policy of water conservation. The tasks of these five ministries strongly overlap (Kaisi et. al; 2007) and the activities are often fragmented between different institutions (Peters et. al; 2008).

The Higher Water Committee was established to control, protect, and coordinate the tasks of the different players in the water sector. This committee was formed in 2000 and was modified again under a new decree in 2008, with almost the same tasks of the integrated water resources management directorate in the Ministry of Irrigation. However, the members of this committee are the main decision makers in the country. Policy setting in the water sector is divided between the four ministries: irrigation, housing and construction, agricultural and agrarian reform, local

administration and environment. Nevertheless, this policy is fragmented and communication and interaction between the different partners is absent (INECO; 2009).

In Syria, the water sector is administrated by a number of organizations and ministries with slim overlapping in accountabilities.

- Ministry of Irrigation (MOI),
- Ministry of Agrarian Agricultural Reform (MAAR),
- Ministry of Housing and Construction,
- Ministry of Environment and Local Administration.

The responsibilities of MOI and its directorates in the districts are water management and development, periodic observation of surface and groundwater quality and quantity, and water delivery for irrigated agriculture.

The tasks of MAAR are supervising the economic use of irrigation water within the agricultural sector, including the research for developing up-to-date techniques for minimizing water losses and develop little-water consuming and tolerant to salinity yields.

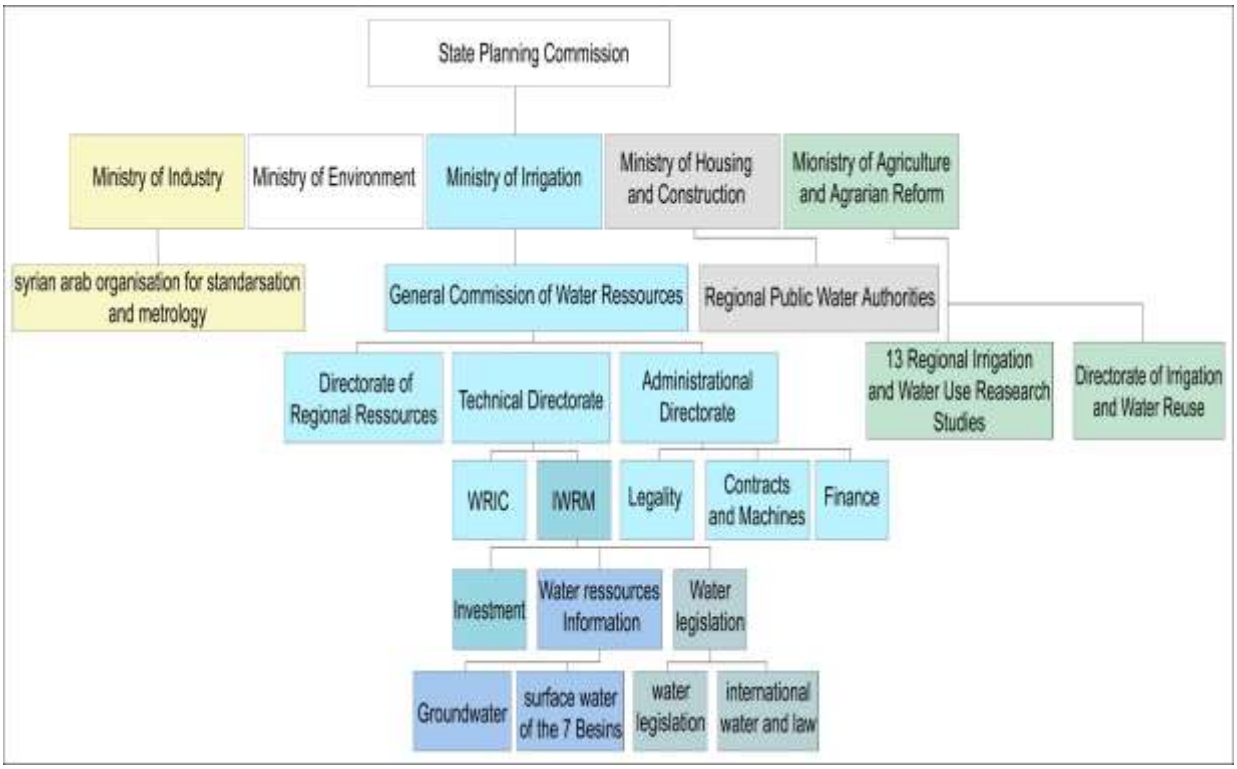
The Ministry of Housing and Construction is responsible for supplying water for rural and municipal areas and for sewage water treatment.

The monitoring of water quality and developing the required standards for water resource protection is the responsibility of Ministry of Environment and Local Administration (Mourad & Berndtsson; 2012).

The ministries are represented, at the province or basin level, by a number of directorates. For example, the MOI has a General Directorate of the Basin and Directorate of Wastewater Pollution Control in all provinces. The Ministry of Environment has particular directorates for water safeguarding and controlling of waste. The Ministry of Housing, in all districts of Syria, has General Companies for Drinking Water and Sanitation and a General Company for Sewage Water.

According to Syrian Water Strategy (2003), due to the significance of water resources and for their protection from degradation and exhaustion, the administration, parallel to the building of dams and formation of irrigation projects, has taken the following procedures to realize the sustainable development of WRs:

Figure 14- The structure of the water sector in Syria



Source: Hübschen, 2011.

- Assessment of water resources to formulate additional water reserves showing water movement course and aquatic -interaction, discover underground water layers, and clarify groundwater regeneration and discharge.
- Development of a general water plan through categorizing present and upcoming practices until the year 2025; gathering, handling and recycling non-traditional water (wastewater, drainage water, and others); observing water quality and capacity; and evolving programmes for training and qualification.
- Creating of a general exploration plan to advance water resources and rationalize agricultural water use. This plan includes research programmes on modern water-saving irrigation methods and techniques, which formed a scientific bases for the government`s resolutions to implement a national programme converting to modernized irrigation in irrigated agriculture,
- Operation and conservation of irrigation projects by paying attention to utilisation and preservation in terms of delivery of needed equipment and workforce developing and rehabilitating longstanding irrigation schemes,

- Rationalization of water consumption, reached by relating scientific investigation outcomes to decrease losses in on-farm water supply systems by means of modern irrigation techniques, choosing suitable lands, applying proper irrigation methods and crop cycle by soil category and properties, and preventing damages and encroachment on water structures.
- Innovation of water acts and administrative structure to realize ideal administration of WRs for numerous activities; negotiations of water use rights and water security from contamination and keeping step with manufacturing progress and its considerations on WRs (Water Strategy of Syria, 2003; Country profile Syria; 2005).

Furthermore, the New Water Legislation was initiated by the Presidential Resolution No /31/ dated 11 July 2005 which was developed and adopted by the People's Assembly. Relevant technical, legal, legislative, and scientific commissions studied the New Water Legislation for long time to escape gaps made in the previous legislation and to set regulations for water usage and water structure conservation. This resolution consists of /58/ articles in /12/ chapters.

According to the government orientation towards enhancement of water resource management in Syria, the General Commission for Water Resources was established on the basis of Legislative Decree No /90/ passed by the President on 29 September 2005 (GUP; 2005).

According to the Development Information Programs in Syria, the responsibilities of this commission are summarized as follows:

- Administration, improvement and conservation of WRs in the seven water basins in Syria,
- Observation on exploitation of WRs and water structures in water basins in the governorates
- Synchronization between Ministries of Irrigation and Housing to assess drinking water sources and develop recycled sewage water.

The MOI's Technical Directorates and Irrigation Departments at General Commission for Water Resources will replace the previously established General Directorates of Hydrological Basins established by Resolution No /17/ on Establishment of the Euphrates Dam. The General Commission will have a separated financial plan with an autonomous division incorporated to the MoI's financial plan and covered in the State's balance sheet with all expenditures and profits. The Commission's board involves representative experts from accountable ministries (MOI, MAAR, Housing, and Municipalities and Environment).

The Commission's executives were fixed in the Syrian provinces. Centres belonging to the Commission were also constructed. The tasks of the Commission and its Directorates are identified by Resolution No /1916/ on 27 November 2005, including the executive guidelines of Decree /90/ (Ministry of Information; 2003-2006; Kaisi et. al; 2007).

4.3.4. Balancing the demand for water resources and their relationship to future prospects for their use

Until recently, development activities within the Syrian water sector were on the water supply side. The attention to demand management and improvements in patterns of water use was negligible. Water managers and planners gave the highest priorities to detecting, increasing, and managing new water resources. Enlarging the national water budget with new water was always a main goal of the national agricultural policies. This goal was achieved through building new dams to control the surface flows and creating multi-purpose reservoirs. The number of dams in Syria is approximately 160 with total capacity of 140 BCM (billion cubic meters). The policy direction was to achieve self-reliance in basic food products and food security so that irrigation systems were constructed and agricultural activities were extended into large areas. However, the present water sector's policy in Syria, due to the high cost of developing less accessible water, is much more oriented toward demand management by giving more value to the efficient utilization of water resources in agriculture (Haddad; et. al; 2008). The total amount of the renewable water resources in Syria is under the water shortage index (Mualla & Salman; 2004) with less than 1000 M^3/person/year.

According to the National Syrian Policy for Scientific Research (2011), the total demand for water resources in Syria exceeded the available renewable amount from these resources in the majority of the national water basins whether for surface or for ground water. The total water demand for 2009 reached 20.880 Millar M^3/year, which equals 108% of the annual available incoming water (Agha; Sibai and Daoud; 2011; in Arabic). In some sub-basins or in some periods of the hydrological year, the freshwater resources do not cover the expected demand for water for drinking and household purposes in the drought periods.

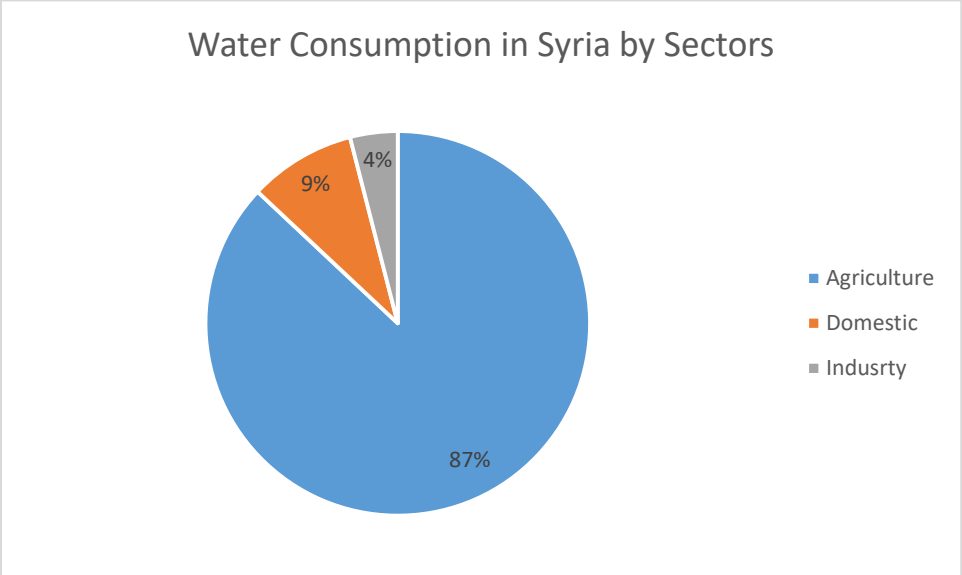
The annual water demand in the last 15 years has exceeded renewable water amounts by 14% (GTZ; 2010). The total national demand on water is expected to rise in general due to the increasing population of Syria and in accordance with the scenarios of development of various economic sectors. To avoid the destructive effects of the crisis in Syria, human society must be provided with water for drinking and health purposes. The requirements for the purposes of industrial water supply needs and for power generation or extraction of primary resources are

related to the quality of the applied technological processes. In the agricultural sector, the largest water consuming sector, the water needs of plants are variable and related to their biological ingredients and requirements during phonological growth periods. The waters needs of plants are affected by climate change and related adaptation measures and their impact in changing the availability and the demand on the resources in one time. The losses caused by evaporation from artificial water reservoirs will increase.

According to the National Strategy for Environment (2003), the preparation of water balance in the Syrian Arab Republic depends on the use of a simple comparison between the demand for the water resources in the various economic sectors, especially in the irrigated agricultural sector, and the available water resources from various sources at the national level. Then, the results are compared with the basic principle of IWRM, which balances between demand and available water resources (National Strategy for Environment; 2003; in Arabic).
Considering that irrigated agriculture is the largest water-consuming sector (85% to 88% from the total water consumption [see Figure 15] for different water sectors), evaluating the water demand in the agricultural plans for irrigated areas with an appropriate mechanism is essential.

When calculating the water balance between the accessible water resources and the demand for water resources, the level of regulation of water facilities, the evaporation losses from water bodies, and the percolation losses outside the borders of Syria should be considered. The value of a water shortage can be determined within the season or within one hydrological year, and/or from estimating the percentage of the demand it covers during the critical period.

Figure 15- Water consumption in Syria by sector



Source: Daoud; 2013.

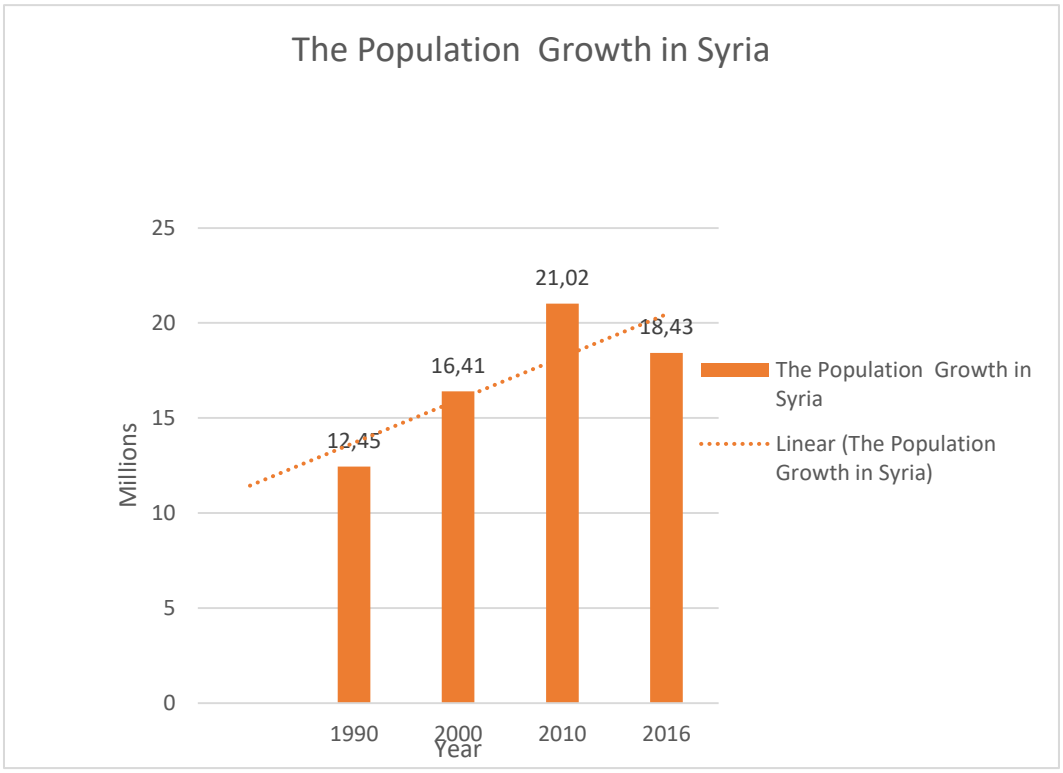
The water crisis is apparent in all Syrian cities, especially in summer, when the water supply is rationed (Wannous; 2014).

The pressure on water resources, caused by population increase and socio-economic development for all development sectors, resulted in a qualitative and quantitative fluctuations to these resources. The water resources, due to their limitedness in relation to increasing water demand by all human activities in all sectors (e.g., agriculture, domestic uses, industry), form the most complicated and difficult circle. Syria, like other East Mediterranean states, is characterized by low precipitation with annual and seasonal disparities and low water use productivity in agricultural sector that overwhelms more that 80% of the total water amounts (Kaisi et. al; 2007).

The studies of water balances from 1992 to 2010 indicated a deficit in securing the demand for water resources, not only in periods of water scarcity but also during the entire hydrological year in areas expanding toward the other water basins.

The population growth in Syria is high (see Figure 16 below). The Syrian population developed from 3 million in 1950 to about 22 million in 2012, causing a shortage in the countries total available per capita renewable water from over 5500 m^3 per person per year to less than 760 in 2012, which is considered as scarce (Gleick; 2014). The inhabitants of Syria are estimated to increase to 37 million by 2050 (World Population Prospects; 2013).

Figure 16- Population growth in Syria



Own compilation. Source: World Bank, Data Bank.

According to the world's economic consideration, the number one global risk, which can have a devastating impact on society, is the water crisis. The Syrian people have access to only 300 cubic meters of water per person, while 90% of Syria's water is used for irrigation (De Châtel ; 2014). This water shortage is expected to increase due to population growth and evolution in different sectors.

The approach to solving the water problem in Syria has focused on the extraction of new resources without considering the management of these resources (Haddad; et. al; 2008).

The water balance, which is achieved through the basic principle of IWRM, is traditionally calculated on the national Syrian level on several layers. The aim of balancing water resources is to clarify the situation of water resources and planning them and to achieve performance evaluation in various water using sectors, through:

1. National water balance to meet the expected demand: the comparison between the demand for water resources (not their uses) and the available estimated water resources (not the actual) from these resources in every hydrological year.

2. National water balance to meet the irrigated agricultural water demand: the water resources available for irrigation in dry years are compared with the demand for water resources for irrigated agriculture (through the plan of demand to secure the production of agricultural needs).
3. Groundwater resources balancing with the probability of a dry water resources year: the organized water resources for the dry years are compared with the demand for them through pumping water from their water tables in the wells used for irrigated agricultures.

Table 2 presents the water balance of the major water basins in Syria (Badia, Euphrates, Orontes, Barada and Awag, Tigris and Khabour, Yarmouk, and Costal,) for 2009.[8]

Table 2- Water balance of the major water basins in Syria

The Components of Water Balance	**Unit**	**Water Basins**							
		Tigris & Khabour basin	Euphrat basin	Orontes basin	Costal basin	Barada & Awag basin	Yarmouk basin	Badia basin	Total
Total available conventional water resources	Mil. M^3	2148	6619	1954	2993	758	253	171	14896
Total conventional and non-conventional water resources	Mil. M^3	2 802	8403	2340	3105	972	337	174	18134
Total water consumption in Agricultural Sector	Mil. M^3	5427	7255	2045	436	668	234	115	16180
Total water consumption in Domestic Sector	Mil. M^3	129	526	305	129	301	121	42	1553
Total water consumption in Industrial Sector	Mil. M^3	11	153	235	45	33	32	10	519

[8] Water Management Plan Committee (2010). Water resources management and studying the current and future water requirements for all development and economic sectors.

Annual Evaporation	Mil. M^3	35	1660	122	785	0	18	9	2629
Total consumption and losses	Mil. M^3	5602	9594	2707	1395	1002	405	175	20881
Water Balance	Mil M^3	**2800 -**	**1192 -**	**366 -**	**1710**	**30 -**	**68 -**	**1 -**	**2747 -**

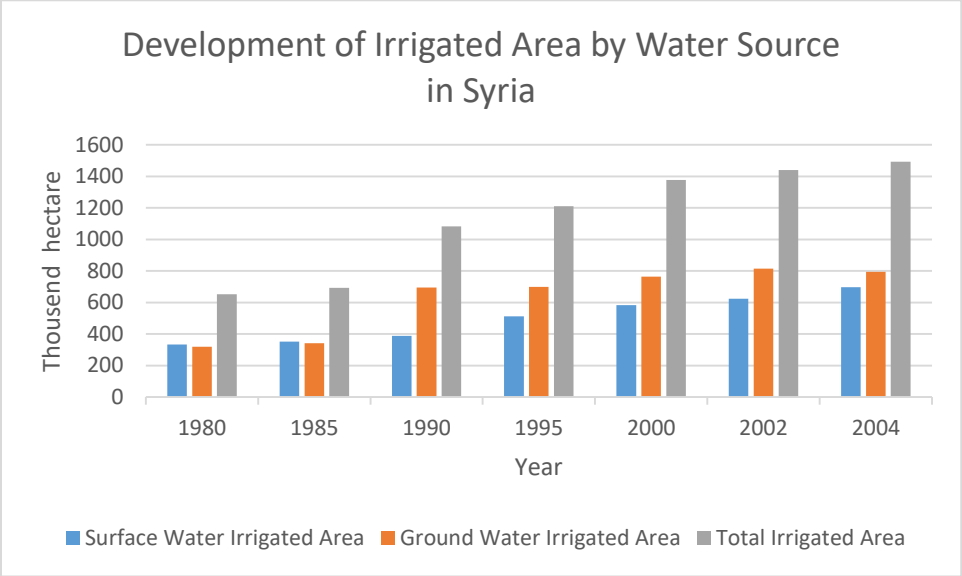
Source: Daoud; 2013.

Syrias' total water use capacity is about 20,881 million m^3/year. The datasets on the availability of water reflected a negative annual balance of about 2747 million m^3, mainly due to excessive groundwater over-pumping. In most basins, with the exception of coastal and steppe basins, the water balance is negative, which is evidenced by the dramatic dropping in the depth of the water level.

4.3.5 The water balance for the water resources is not an actual balance for their use

According to AW-Hassan et. al; (2014), both the irrigated area from ground water and the number of wells dramatically increased from 1980 to 1990 (see Figure 17) (AW-Hassan et. al; 2014). About 18% of the total Syrian wells are in Damascus and rural Damascus, 87% of which are illegal (Hübschen; 2011). The total irrigated area, by pumping water from both legal and illegal wells, estimates 715, 509 ha. The most common irrigation method in Syria is surface irrigation applied on 95% agricultural area. The efficiency of irrigation is low and reaches only 40% in the old canal-systems and 60% in the newly established irrigation projects (MAAR et. al; 2001). The high dependence on the ground water in irrigated agriculture leads to a disruption between the renewable available ground water and volumes of withdrawn water from the ground water table

Figure 17- Development of irrigated area by water source in Syria.



Own compilation. Source: Kaisi et. al; 2007.

The water shortage in Syria began to develop in the mid-1980s and has grown consistently for two reasons:

- The expansion in the irrigated areas, especially using ground water resources through pumping water from wells.
- Successive waves of drought in the last decade, especially from 1998 to 2001 and from 2007 to 2010.

The irrigated area in Syria has nearly doubled since 1985 (Winckler et. al; 2016). The agricultural policies have been given a great attention as Syria's economy has been mainly based on agriculture, which has a high level of decision making. The government's major stated objective was agricultural self-sufficiency. The application of self-sufficiency caused increases in production of certain crops and thus exports of these productions counterbalanced the need to import other goods. Generally, the self-sufficiency succeeded in improving wheat, cotton, and barley production. This improvement ensured an acceptable level of national stability and reduced the country's vulnerability to global market volatility. However, this progress came at the expense of irrational water use arrangements causing water shortages in most basins, especially groundwater (Haddad et. al; 2008).

Jessica Barnes argued in her book *Managing the Waters of Baath Country* that the intensive agricultural policy of Baath-party is the reason for the water crises in Syria. She noted that the

Syrian government policies in promoting irrigated agriculture for achieving food security caused the water scarcity (Barnes; 2009).

Each water-balancing plan needs to consider the actually available from this water resources. It is also necessary to distinguish between water demand and the actual use of water resources for producing material values in the targeted sector (Water use & Water consumption) and between water supply and water withdrawal from the water source to secure the allocated demand needed.

Based on the scientific terms describing different water balance plans related to various concepts and standards, the water balance plan should begin at the main water basin.

4.4. Challenges of the water sector in Syria and the need to apply IWRM

Social and ecological systems are affected by several climatic and non-climatic factors, such as present demographic developments, economic progress, and associated changes of using lands, which have straight effects on the social and ecological systems and their progressions. These factors of change are strictly related and produce management problems for land and water resources.

For dealing with these compound problems, water management questions should generally consider several decision standards and huge numbers of possible options, usually characterized by a high uncertainty, complex interactions and contradictory interests of multiple participants, and diversity of divisions, such as coastal ecosystems or different economic sectors (Giupponi et. al; 2017).. Therefore, IWRM, which is widely accepted on the international level as a method to efficient and equitable management of water and interrelated resources, should replace the traditional fragmented approach of management.

In the following sections, the main management challenges for the Syrian water sector, as well as the corresponding solutions to each challenge, are explained.

4.4.1 Institutional development (administrative challenge)

The water authorities have overlapping responsibilities and limited coordination. According to Hinnebusch et. al; (2011), the agricultural policy, which is tightly related to the national water strategy in Syria, remained bureaucratic and fragmented from 1963 until 2000 (Hinnebusch et. al; 2011).

The data sharing between water authorities and ministries in Syria is limited and often accompanied by bureaucratic procedures. The secrecy around water and its sensitivity resulted in a lack of transparency. The data is not shared between governorates and many government

research bodies and institutions. There is no unified method to assess countries' actual water resources, so the resulting data sets are contradictory (GTZ; 2010).

However, the relevant ministries' procedures call for deepening the general trend of restructuring, including increasing compatibility with water legislation (law 31/2005), regulating instructions for its application, and cancelling all paragraphs that oppose it. Therefore, the Ministry of Water Resources has begun working on the basic structure of the General Water Plan of Syria by collecting data and information for the base year 2010-2011 for most water basins.

For example, not limited to the water resources actually used for drinking and household purposes in Barada and Awag river basins has formed about 345 m^3 of water in the year 2010, which is more than the incoming water into this basin by 67% considering the dry year probability and about 43% from its average natural resources.

All the involved agencies in the water sector emphasize acquiring and supplying water for civilian uses (drinking, industry, power generation). The Ministry of Water Resources and Ministry of Agriculture plans show that the demand for water resources to ensure water for irrigation exceeds 1100 Million M^3/year, which is more than the incoming amount of water resources into the basin by 270% (which is supposed to be the base of planning for irrigated areas).

The efficiency of the planning process and the return of implementation plans and development are affected by the improper calculations of available water resources. The poor planning is affecting the multi-sectoral national economy level and also the level of each of the developmental sectors and in each specific site.

The first planning goal of the Syrian water sector, as listed in Chapter VII of the Tenth Five-Year Plan, is for the irrigation and water resources sector: 'Develop a comprehensive national plan for the integrated use of the available water resources, its good management and achieving its sustainability'.

The achievement of this main goal requires a drastic move toward demand management for water resources at the level of each of the major water basins to balance between the available resources and the demand for them. Although serious work has been completed on the development of the legislative structure, laws, and regulating instructions, the institutional structures and structures of ministries must be rehabilitated in line with integrated management to avoid the management of one suspended sector (Daoud; 2013, in Arabic).

Nonetheless, decentralization and subsidiarity in water resources management, as a basic element of the IWRM paradigm, have become attractive options for countries with large or complex watershed system. According to Stoa (2014), the principle of subsidiarity implies that ordinance and policy-making should take place at the lowest applicable level of authority. The principle encourages effectiveness and local ownership over decision making process, while the check and control are in the hands of central administration and union of authority is at the greatest level of government. The most important characteristic of IWRM planning is to reconstruct management structures and organizations along hydrological borders. Drawing hydrological borders according to the features of water resource enables the IWRM plan to be more approachable to local ecological variables (Stoa; 2014). The paradigm of IWRM unreservedly supports the construction of decentralized decision-making when the water management systems are restructured accordingly, where water resources management is mainly undertaken by organizations at the level of the water resource (De La Rochefoucauld et. al; 2017).

Decentralization of water resources management, along with the broader framework of IWRM, is expanding around the world because these methodologies are regularly endorse a drastic development over regulation and governance style of water law and decision making process.

4.4.2 Climate changes (natural challenge)

The water resources in Syria are particularly important for the following reasons:

- The decrease in per capita quota from water resources in the growing population,
- The strategic importance and decisive and immediate impact on the overall economic development
- The adverse changes in the amount of renewable and available water resources resulting from the effects of climate change, especially in the driest basins.

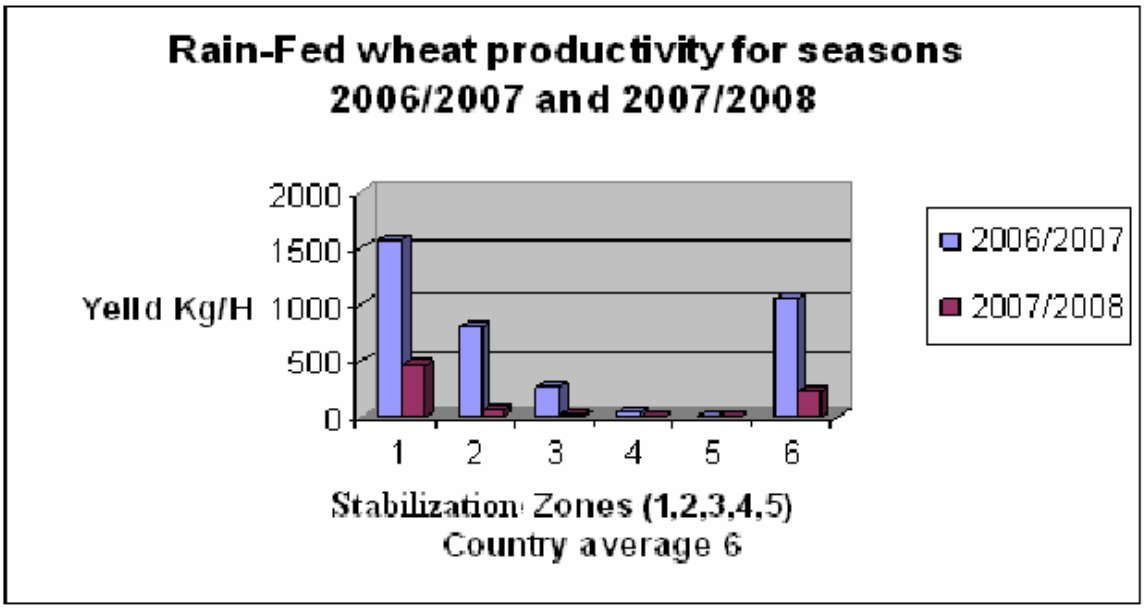
The region suffers from the drought. Syria's annual rainfall estimates 250 mm, and the country is considered one of the driest in the world (Reig et. at; 2013). From 2006 to 2009, the agricultural failures affected about 1.3 million residents of eastern Syria. Around 800,000 people lost their elementary food support (Solh; 2010). The production of wheat and barley fell to 47% and 67%, respectively, and the livestock population dropped (ACSAD; 2010).

At the beginning of the national plan, agriculture provided more than 25% of the national output (GDP). However, this ratio has decreased gradually not only because of the development of productivity and the share of other sectors, but also as a result of these resources declining due to the impact of climate change. Irrigated agriculture plays a crucial role in the overall

production process, securing about 40% to 45% from the total agricultural winter production and more than 70% in the dry years (2007-2008), since the irrigated agriculture provides the whole intensive-summer production. The results of the various research studies associated with the productivity of non-irrigated barley indicate a decrease in the productivity of barley by more than 12% to 58% up to the region and so is for the wheat production too (see Figure 18). This decrease is due to the displacement of stabilization zones in the northwest from 1972 to 2008 and the expansion of the Syrian desert (Badia) to cover 63% of Syria (Somi et. al; 2006). According to Giupponi and Gain (2017), the increasing global warming will threaten a larger part of the world`s population, which will experience water scarcity and riverine floods. Food safety will be possibly affected by the change of climatic conditions, counting food production, delivery, process, access, use, and price permanency since agriculture is straight related to availability of water. In the low-income developing countries and in many regions, climate change and associated influences on water are estimated to lead to increased water-related sicknesses (Giupponi et. al; 2017).

Reducing the negative impacts of climate change requires minimizing the tension on water resources that contribute to economic, public, political, and ecological disorders. In the MENA region, the efforts should mainly concentrate on improving productivity of water use to harvest higher crops and income with fewer water within the agricultural sector due to the high dependency of local economies and occupation on that sector. In Syria, the high probability of increasing temperatures and reduced water streams due to climate change indicate the urgency to establish long-term agricultural reforms with certain kind of political reliability, including sustainable ground water management and revision of crop types and planting patterns. The excessive ground water usage has been affecting the suitability of ground water, which could be balanced by applying the appropriate economic, regulatory, and management policies (Gleick; 2014).

Figure 18- The production of non-irrigated wheat in the dry year 2007-2008 compared to year 2006-2007[9].



Daoud; 2013.

The instruments of IWRM can directly allow communities to cope with climate variability through managing of the water resource at the appropriate level, policy development, and the regulation of membership in management practices, and guaranteeing that the affected users are involved. The potential of IWRM in reconciling varied and unstable water uses and demand was recognized in 2001 by the Inter-governmental Panel on Climate Change: IWRM offers more flexible and adaptive capacity than conservative water resources management methods. Reducing communities' vulnerability to climate change needs an enhanced capacity to adapt to its effects. The tools and instruments of IWRM manage the entree to water and protect the wholeness of the environment, thus conservation the water resources for upcoming generations. According to the IWRM operational guides (2010), the way in which IWRM can assist in adapting to climate change can by summarized as follows:

- Through proper monitoring of water quality and quantity developments, management can positively take action toward adaptation;

[9] FAO 2008. Drought Assessment Mission, Syria for 2007 -2008.

- A key function of IWRM[10] enables direct involvement in dangerous events, like flood and droughts;
- Incorporating risk assessment and adaptation measures in basin planning;
- Allocating water for the most competent and effective usage to flexibly respond to climate change (Cap-Net; 2010).

According to the publication of Cooperative Programme on Water and Climate (CPWC), there is a solid link between climate change and the water sector. The IWRM methodology is considered the finest to address the effects of climate change. The proper implementation of IWRM ensures the ability to deal with ever-changing conditions. Water demand is changing in relation to a number of variables, such as population growth and economic development. The climate change represents complex variability, such as inter-annual and seasonal. By concentrating on reliable solutions, IWRM can cope with this variability (CPWC; 2008).

Integrated Water Resources Management (IWRM) is encouraging mechanism for exploring adaptation to climate change. Mainstreaming climate change in water management provides an exceptional prospect for lessons and information exchange on IWRM and climate change, concerning how they may contribute to, or destabilise, each other (Giupponi et. al; 2017).

4.4.3 Water resources management in the water using sectors (technical challenge)

Inappropriate water management conclusions, poor planning, and strategy failures have worsened the water balance in Syria. The Syrian Government used to provide great sponsorships for the production of water-intensive crops, like wheat and cotton. The irrigated farming needs to be modernized because of its dependence on flood and inefficient and traditional irrigation methods. The main source of irrigation is ground water, which is over pumped (Salman and Mualla; 2004), causing depletion of groundwater and increasing costs of production. Wada et. al; (2012) estimates that 78% of ground water withdrawal in Syria is over pumped, so the recharge level cannot compensate for the pumped amount of water used for irrigation.

According to the Water Strategy of Syria (2003), to alleviate the water crisis, one of the following methods is applied. The first method, based on the water supply management, addresses water scarcity as the main reason for the crisis. The solution, from the decision-makers' viewpoint, should be based on three points:

[10] Key water resources functions are pollution control, monitoring, financial management, flood and drought management, information management, basin planning, and stakeholder participation (D. Thalmeinerova, based upon GWP Toolbox resources; www.gwpforum.com).

- Searching for new water resources (on the local level and from sources from outside the water basin),
- Increasing the water storage capacity and the degree of regulation of water resources,
- Transferring water between basins.

The second method is based on managing the demand for water. Improper management of the available water resources and low level and efficiency of water use are considered the main reasons for the sectorial crisis. In this case, the solution involves the following points:

- Identifying and legalizing the demand priorities and sectoral allocation,
- Rationing water consumption in all sectors,
- Reallocating water resources for the sectors with higher socio-economic returns,
- Increasing the efficiency of available water resources used to increase the revenue of water unit in the concerned economic sector,
- The application of the economic tools for the following:
    1. Recovering the operation and maintenance costs
    2. Avoiding the direct subsidies,
    3. Reducing the pollution resulting from improper use (polluter pay principle, for example) (Water Strategy of Syria; 2003).

For the well-being of water resources and to reach sustainable water use in Syria, in the light of the actual water balance, which indicates a water shortage in most of water basins, it is necessary to completely shift from water development (water mobilization) to water management, namely to management of water demand. In the basins with huge urban areas, water efficiency should be enhanced to meet the water requirements for the rapidly increasing population (about 3%). The development of new water resources, which are scarce, is extremely expensive (Haddad et.al; 2008).

In addition to identifying problem area and priorities for water management, IWRM aims to enable the regulation and arrangement of the increase and management of water resources. This realignment should shift conditions by means of systematic and continuous recording and supervision of water resources and demand behaviour. Therefore, effective monitoring and the future use of data on water availability and demand are instruments of a successful IWRM. For proper evaluation and to determine the balance between the supply and demand for water resources, updated and complete knowledge about water availability and demand for water resources is needed (Hübschen; 2011).

Effective water management requires an effective water resources knowledge base, which contains data affecting the water demand and provides predictions about the development of the water sector. Professionals, practitioners, and the general public should have access to this knowledge base to use it effectively. Establishing an information management system will encourage the implementation of IWRM principles (GWP; 2000).

4.4.4. Meeting the water needs of the various economic sectors (technical challenge)

Increasing the water supply to satisfy various water needs is not a more rational solution since the marginal costs tend to be much more expensive economically, politically, and environmentally. Allocating water among increasingly competing activities is becoming extremely challenging. The imbalance between water supply and water demand has contributed to many water conflicts (Wolf; 2002; Gleick and Heberger, et. al; 2014). The various economic sectors are competing for the use of the available water resources. Each of the sectors (e.g., civilian and drinking water supply, industrial water supply, agrarian water supply, and water for health and environmental requirement) are limited water resource consuming sectors. The competition for the limited water resources among these sectors may create rivalries. Thus sectorial priorities should determine the mechanisms for allocating the water resources among these sectors.

According to the basic principles of IWRM, regarding competing or conflicting use the most critically affected sector by pollution from other water uses is the domestic water supply and sanitation sector. Since the demand for water is great, competition appears on different levels within and between sectors, especially between irrigated agricultural and domestic water supply sectors. For example, over-pumping of ground water for irrigating agricultural crops causes depletion of the ground water level and a deficit in domestic water supply wells. Furthermore, the quality of water is negatively affected by pollution from agricultural and industrial sectors (pesticides, fertilizer, and hazardous materials) or by untreated wastewater. The critical importance of an uninterrupted domestic water supply, from one side, and the need to satisfy the other critical water demand in other water consuming sectors (especially in irrigated agriculture), from the other side, causes serious conflict in the allocation of domestic and other needs (Cap-Net; 2004).

The water resource situation in Syria, due to high population growth and expected climate changes, is likely to worsen and will be accompanied by growing competition for water without key policy-making changes and real enhancement of water management process and techniques.

The application of IWRM guarantees safe access to the domestic water supply to all segments of the society, tackling the pollution of water resources more effectively and reducing the conflict between water users. Using water efficiently through better appreciation of water as an economic good and greater integration of the general public, including women, in management of water resources will decrease the conflict between water users by guaranteeing efficient use in competing sectors. The scientific IWRM approach offers an effective method for quantitatively and qualitatively managing competition for the limited water resources to ensure maximum economic, social, and environmental revenue on the multi-sectoral national level, despite the potential and probable losses that may occur within each sector.

4.4.5 Shared international water resources (political challenge)

Water basins may extend into areas that exceed the administrative borders of countries and specific regions, which leads to overlapping rights to surface and ground water sources and resources. The competition for the quantities and qualities of these resources among most partners is more rivalrous than among users within the borders of the same country, which presupposes the existence of regulatory framework agreements on common water basin level. Such agreements differ up to the nature of the water resource, the quality of its uses and the qualitative impact within the respective territories of the riparian partners. Thus, IWRM will contribute to managing the interests of the upstream and downstream river and protecting the river basin environment.

According to Shamout and Lahn (2015), the entire water resource of Euphrates River is in crisis. Over-exploitation, inhabitants' development, contamination, and other factors have been reasons for its degradation for many years. The ongoing war and disorders in the region worsen the situation: preventing policy cooperation and threatening main infrastructure. The catastrophic humanitarian crisis created by the conflict will increase through stresses on the river`s resources. Urgent attention is needed to rebuild cross-border coordination in the region (Shamout and Lahn; 2015). The Euphrates River in Syria is considered the largest surface water resource (86% of the total surface water in a dry year) and flows in three riparian states, Turkey, Syria, and Iraq (see Figure 19).

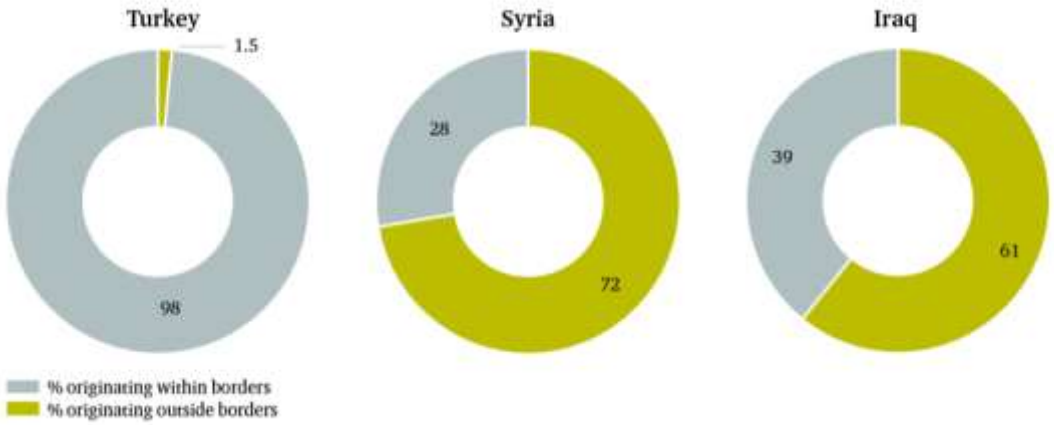
The relationship between these countries is organized by agreements, protocols, and memoranda of understanding with emphasis on two main points:

Firstly, the agreements and protocols signed between Syria and Turkey in 1987, and Syria and Iraq 1989 remain temporary, as stated in article VI of the Economic Cooperation Protocol with Turkey (until the filling of Ataturk-reservoir). The agreement stipulates that Syria's and Iraq's

share is more than 500 M^3/Sec at the Syrian-Turkish border. The agreement between Syria and Iraq stipulates that allocation of this share is 42% for Syria and 48% for Iraq, delivered at Abu Kamal (Syrian-Iraq border).

Secondly, there is no final triple agreement among Syria, Turkey, and Iraq about sharing the Tigris river water. However, there is an Iraqi-Syrian agreement on the withdrawal of 1250 Million. M^3 of water on the Syrian side, according to an agreed program between the two countries for irrigating 150,000 Ha in north-eastern Syria (Daoud; 2013; in Arabic).

Figure 19- The dependence of Turkey, Syria, and Iraq on trans-boundary water resources



Source: FAO, 2015; AQUASTAT Database, et. al; Shamout and Lahn; 2015.

According to Gleick (1988), conflicts over international water resources, such as river basins, will be difficult to resolve because of the increase in human-induced climatic change. There are many examples of unresolved disagreements over water rights and use, which contribute to international friction (Gleick; 1988). The countries missing an administrative and institutional framework for conflict resolution and crisis management and are exposed to the greatest water stress. Generally, there is a compound causal connection between hydro-climatology and water-related political affairs, which relies on socio-economic circumstances and institutional capability, as well as the time and appearance of fluctuations and extremes in a country and basin (Scheffran and Battaglini; 2011).

International shared water resources can motivate cooperation. Water stress is affecting a growing number of states since, in most cases, mechanisms and organizations to manage disagreements over water resources are either missing or insufficient. The rivalry for shared water resources can increasingly become a cause of conflict between states and sectors. Previous experiences have shown that the dynamic nature of freshwater can be a stimulus for cooperation since it can oblige users to merge their different views, through negotiations,

instead of one-sided decisions that may lead to escalation and harmful confrontations, which could threaten water supplies (Unesco & Green Cross International; 2003).

The studies have suggested that establishing institutional capacity, based on the cooperation of stakeholders, in form of convention, settlements, or unofficial working relationship can assist reduce the probability of conflict (Wolf, Stahl & Macomber; 2003; Yoffe, Wolf, & Giordano, 2003; Yoffe et.al; 2004; et. al; Jacob et. al; 2017).

According to Giordano and Wolf (2003), the main characteristics of effective institutional capacity that prevent water conflict are listed below:

- Adaptable management structure, including public participation, change of basin primacies, and new statistics and observation technologies,
- Transparent and elastic allocation criteria among riparian countries,
- Rightful delivery of benefits,
- Detailed mechanisms for conflict resolution (Giordano & Wolf; et. al; Jacob; et. al; 2017).

Trans-boundary river basin management, as main challenge of IWRM, received special attention at the Hauge Forum, the Bonn Conference, and the World Summit on Sustainable Development, in Johannesburg, in 2002. According to IWRM, water should be meant for communal improvement, peace building, and protective mediation. Consensus building among societies and coalescing conflicting interests can be achieved through the overreaching value of water. A cooperative watershed management process is needed to combine all the physical, governmental, and economic characteristics of a river basin. Therefore, water should be managed on river basins, not only on administrative boundaries.

However, many obstacles prevent optimal watershed management:

- Absence of clear mechanism for implementation of river basin management,
- Lack of enforcement of river management plans by existing river commissions,
- Absence of local public membership,
- Lack of formal settlements on international water sharing, restrictions of contamination and economic and military disparity between upstream and downstream states.

Generating joint policy, including supporting a legal framework, is needed to implement integrated trans-boundary river basin management. In addition to developing plans and goals, IWRM aims for practical frameworks to apply combined river basin management by establishing competent organizations and active participation of all riparian countries.

Furthermore, legally binding agreements and provisions are important to guarantee the proper implementation of integrated policy (Rahaman and Varis; 2005).

4.4.6 Environment protection (natural challenge)

Changing climatic conditions may result in harsh drought in Syria, but the continuing failure in regulating the water use and the lack of water and environmental law enforcement represents a greater danger to the countries natural resources (De Chatel; 2014,). The over-exploitation of water resources and the disposal of liquid waste products of various kinds leads to the degradation of water resource quality. Usually, paying attention to this issue in its final stages makes treating the problem more difficult and costly.

According to Schultz (2001), until recently, technical efficiency (engineering); performance reliability (social); and economic benefits (economy) were used in the design and operation of water management schemes. After the World Commission on Environment and Development`s report appeared, new UN (WCED; 1987) approaches became relevant. The two most important approaches are sustainable development, which was advocated mainly by the UN, and integrated river basin management, which is strongly supported by the EU. The EU established a council directive to adopt new legislation that instructs all member states to introduce the integrated river basin management approach (Schultz; 2001). One of the most significant principles of the execution of prevention and sustainable development principles is the environmental impact assessment (EIA) principle. The framework of IWRM includes the application of many related principles. The concept of EIA is a critical element of IWRM (Manouris and Gioutsou; 2006). The field of environmental assessment has expanded from its beginnings in the 1960s. There are two levels of environmental assessment recognized by practitioners: EIA, which is practical at the level of specific schemes, and strategic environmental assessment (SEA), which is practical to procedures, programmes, and strategies (CPWC; 2008).

The concept of EIA targets the application of necessary measures to realize integrated environmental impact assessment and programmes that prevent ecological damage and rational resource management. When impact assessment is used to elaborate developmental programmes, regional planning strategies, and preparation of urban projects, it concerns SEA (Cassios; Lee-Walse; et. al; Manouris and Gioutsou; 2006).

The principle of EIA depends on four main parameters: water physics, morphology, discharge, and water chemistry. Water physics is determined by factors such as pH value, conductivity, and O2-content, while morphology of water is related to the bank and land. Discharge includes

hydrological regime, mean values, and others, and water chemistry involves metals, organic loading, nutrients, and wastewater indicators (Schultz; 2001).

The theory of IWRM focuses on the resource management without affecting the environment, creating a broader and more comprehensive outlook. The actual water balance indicates that improper management and unsustainable regulations could not limit the over-exploitation of natural resources. The impact of drought and the economic value of natural resources should not be underestimated for the well-being of the national economy. Combating desertification is important, and there are many examples in the world where desertification fuelled socioeconomic conflict and war since poverty and starvation make tensions rise.

The ignorance of the real conditions of water resources caused many environmental problems, which appeared as the pollution of aquifers resulting from irrigation and over-fertilization, seawater intrusion as a result of over-pumping of groundwater and deterioration of the ecosystem of many lakes and rivers because of pollution, which led to the exit of some of these sources from direct use and increased the pressure on the already limited fresh water resources. Barada River in Damascus has high pollution standard score, such as the biological oxygen demand (BOD), chemical oxygen demand (COD), ammonia, nitrates and suspended matter and heavy metals, resulting from industrial activities along the riverbed. The results of the survey from the Ministry of State for Environmental Affairs reflected a high index of solid waste and a presence of contamination by wastewater in the river. The groundwater is overly polluted by concentrated chemicals and agricultural fertilizers that led to shutting down many drinking water wells.

According to the Netherlands's Commission for Environmental Assessment, the concept of IWRM embraces the assimilation of environment and societal consideration into multi-sectoral conclusions, emphasizes the prominence of participation and a consultative approach to decision-making, incorporates observation and assessment of results, seeks to widen the perceptions of planners beyond instant sectoral problems, and stresses that the consequence is a product (a strategy, approach, or plan) as well as a process. Describing water as an economic good highly improves the dialogue about evaluation of water and water-related ecological services, thus providing a comprehensive understanding of water sector.

The link between IWRM and the SEA has the following advantages:

- Improved stakeholder participation and informed transparent decision-making,

- Wide-ranging and combined understanding of water sector subjects for SEA to inform decision-makers,
- Ensured legal support through necessary entry points in the plan process for IWRM messages (CPWC; 2008).

The IWRM approach can improve ecosystems by giving a voice to the environmental needs in the water allocation debate. These needs were ignored at the negotiation table. Thus, IWRM can help the sector by promoting water users' awareness of the requirements of ecosystems and the expected profits for them, which are underestimated and not included in planning and decision-making. Furthermore, IWRM develops a systematic approach that affords a substitute to a sub-sector competition potential, concentrated on rehabilitation of related ecosystem, to unify stakeholders by creating a shared view and joint action. Such developing a methodology to water management with focus on numerous levels of interference, such as upper catchment protection, contamination control and environmental flows (Leenderste at. et ; 2008).

5. Research methodology

This chapter reviews the choice of research methods and provides an introduction to qualitative and quantitative methods of research. The chapter also describes the research design in terms of population and target group, instrument of research and its validity and reliability, and method of data collection.

5.1. Choice of research methods (quantitative and qualitative)

According to Babbie,(2010), 'Quantitative methods emphasize objective measurements and the statistical, mathematical, or numerical analysis of data collected through polls, questionnaires, and surveys, or through manipulating pre-existing statistical data using computational techniques. Quantitative research also focuses on gathering numerical data and generalizing it across groups of people or to explain a particular phenomenon' (Babbie; 2010).

According to the field guide of qualitative research methods, referred to by Bernard HR (1995) and Denzin NK, Lincoln YS (2000), qualitative research method do the following:

- Look for replies to a question,
- Methodically use a predefined set of measures to answer the enquiry,
- Collect evidence,
- Produce outcomes that were not determined beforehand (new knowledge).
- Produce findings valid beyond the direct limits of the study (Denzin et. al; 2000).

According to Creswell (2014), qualitative research uses phrases, and quantitative research uses statistics or closed questions (quantitative hypotheses) rather than open questions (qualitative interview questions).

Qualitative research explores and understands a phenomenon as it is, in rich detail, while quantitative research studies the relationship between cause and effect (Creswell; 2014).

Ker Rault (2008) mentioned: 'the combined use of qualitative and quantitative methods enables us to study social reality under different analytical perspectives, referred to as triangulation by Jick (1979) and Olsen (2004) or methodological pluralism by Mingers (2001) and Morse and Chung (2003)' (Ker Rault; 2008; P: 47) . Social inquiry must consider how to stimulate data and generate information from different public performers of different environments.

Validity, in qualitative research, refers to whether the research results accurately reflect the situation and whether they are supported by the evidence. In other words, validity indicates whether the research findings are 'true' and 'certain'. Qualitative researchers use the triangulation method to establish validity in their studies by analysing research questions from multiple perspectives. The opportunity to discover deeper meaning in the data is offered by contradiction within data sources and approaches.

Methodological triangulation studies the program using multiple qualitative and/or quantitative methods. When each method's conclusion is the same, then validity is established. Methods used to assess the changes include interviews, observation, document analysis, or surveying the participants (quantitative method). When the findings from all the methods result in the same or similar conclusions, then the findings' validity is established. Triangulation is a widely used method that requires additional resources to evaluate the program and more time to analyse the data/information resulting from the different methods (Guion; 2002).

According to Neuman et. al; (2008), one of the most often used types of triangulation is that of qualitative and quantitative styles of research. The combination of qualitative and quantitative data tend to be more comprehensive since this combination offers the opportunity to examine a phenomenon from several angels instead of one (Neuman et. al; 2008). Methodological triangulation studies a phenomenon using several methods providing confirmation of findings, more comprehensive data, increased validity, and better understanding of studied phenomenon (Bekhet and Zauszniewski; 2012).

5.2. Research design

Quantitative and qualitative data collection methods were used for this research.

5.2.1. Population and target group

For this study, a purposeful selection of Syrian water experts was made. The target group for this study includes 22 water experts working in the Syrian water sector in different ministries and water authorities. This group was distributed between the Higher Institute of Water Management, the Higher Commission for Scientific Research, the General Commission for Scientific Agricultural Research, The Directorate of Conversion to Modern Irrigation, the Ministry of Environment, the Ministry of Water Resources, the Ministry of Agriculture, and the Ministry of Industry.

5.2.2. Research instrument (The Survey of Water Experts)

Two planned questionnaires were used for data collection in this study.

Expert surveys permit us to gain evidences from specialists in a field in which we are less capable or familiar. The survey was created in two stages:

First, a preliminary or exploratory water expert survey for a selected group of three experts was conducted. The survey contained broad open-ended questions.
The results from the literature review and the objective of the research study were used to design this questionnaire, which was constructed to gain initial exploratory knowledge about the Syrian water sector to design a more detailed questionnaire. An investigative design of research, according to Bless and Higson-Smith (2000), explores certain phenomena to generate more definite research questions or hypotheses relating to that phenomenon (Higson-Smith; 2000).

Second, the general water experts` survey was created using the findings from the first exploratory survey to cover the all sides of water issue using both open-ended and close questions.
According to McBurney and White (2007), open-ended questions have two uses:

- Allow participants to provide comprehensive answers and reveal the reasoning behind those answers,
- Help the researchers discover new items that were not expected during the questions' design (McBurney and White; 2007).

5.2.2.1 The preliminary (exploratory) water survey

The questionnaire was divided into several parts (see Annex A) to cover the study's objectives and included questions about the current status of Syrian water sector in terms of the following:

- The enabling environment for development and water resources management,
- The existing institutional frameworks,
- Shareholder involvement and capacity building,
- Development of water resources and water resources management programs,
- Monitoring and information management and knowledge sharing,
- Financing of water management and infrastructure development,
- Priorities of the water management challenges.

5.2.2.2 General water experts' survey

As mentioned, the general water experts' survey was created by means of the results of the literature review (see Annex B) and the objective of the study. Furthermore, this survey benefited from the first preliminary survey, which widened the spectrum of its content (questions).

The survey addressed the key stakeholders in the water sector in Syria (decision makers and employees) to afford a deeper qualitative perception of Syrian involvements in the application of integrated methods to the improvement, management, and use of water resources, as called for in Rio 1992 (chapter 18 of Agenda 21), in Johannesburg in 2002 (the Johannesburg Plan of Implementation) and in the Water Strategy of Syria developed by the cooperation with German Ministry for Economic Cooperation and Development, 2003.

The survey results provided insights into the water situation in Syria and form the foundation for informed decision-making in the Syrian water sector to maintain sustainable water resources management. Furthermore, the survey finding contribute to the formation of basic solutions and policy recommendations for questions and issues arising in the context of modernizing the water sector in Syria, according to the IWRM approach.

5.2.2.2.1. Overview

In recent years, water uses have resulted in escalating and unsustainable practices. Thus, states have to review and develop their strategies and water policies and introduce a set of institutional, legislative, and economic measures to rationalize and maintain the management of water resources (Abed Rabboh; 2013; in Arabic).

As mentioned, the implementation of IWRM is an issue of executing these three main pillars:

- Creating an enabling environment of sustainable water resources development and management, with applicable policies, strategies, and legislation,
- Establishing the institutionalized framework by which the policies, strategies, and legislation can act,
- Preparing the necessary management instruments for these institutions to conduct their tasks (Hassing et. al; 2009).

The reform of the water sector in Syria represents an urgent problem as water services are not regulated to cover the population's daily demand. The region is located in dry and semi-dry lands with strong competitive water use between water consuming sectors (domestic, agricultural, industrial). The survey focused on the actual water management process from the viewpoint of local water experts (decision-makers and employees) from various water authorities and ministries in Syria and investigated the opinions of the researchers involved in water issues.

The survey aimed to clarify the understanding of water challenges and the ongoing water management process, as well as the extent to which the integrated management system is

applied in the Syrian water sector. In addition, the survey estimated the developmental effects of improved water resources management on the Syrian economy, society, and environment.

During the survey, in the first three sections, we asked the water experts to express their understanding about the degree of application of the three basic IWRM pillars, and in the fourth section, they discussed the current status of water infrastructure and its financing plans. Finally, the fifth section estimated the overall impact of the applied improved water resources management on the social, economic, and environmental aspects in Syria in the last five years (since the rise of the Syrian crisis in 2011).

5.2.2.2.2. The sections of the water experts' survey

The survey consisted of five sections, which addressed the five research questions.

The first section contained six questions (Q1 to Q6), focusing on the challenges of the water sector in Syria and on the existing enabling environment. These questions involved developing and performing the necessary policy and the planning of needed legal framework to guide and coordinate water resources management.

The second section had nine questions (Q7 to Q15) about establishing governance and institutional framework: the political, social, economic, and administrative system required to manage the improvement and use of water resources.

The third section consisted of five questions (Q16 to Q20), that estimated the degree of application of management instruments (tools and methods), which qualify the decision makers to make balanced and informed selections between different arrangements, considering the financial instruments necessary to support the permanency of institution, infrastructure, and resources and the services they deliver.

The fourth section was one question (Q21) about the development and financing of the infrastructure in terms of existing national and investment plans to improve the infrastructure and allocate finances from both local and international resources.

The fifth section consisted of three questions (Q22 to Q24) and estimated the overall impact of improved water resources management on economic, social, and environmental aspects.

5.2.2.2.3. Description of the questionnaire

The questionnaire was delivered to 22 participants (Syrian water experts) from different water authorities and ministries from the beginning of June end of July 2016. These questionnaires were delivery thorough mail and online exchange since the possibility for personal interviews

was limited due to the current political situation in Syria. Software (Survey-Monkey) was used to conduct this survey. To expand the reach and the transferability analysis and for further validation of the survey results, the data was triangulated with existing literature.

The questionnaire included both open and multiple-choice questions to provide both qualitative data (verbal answers) and quantitative data (or numerical answers and choices). Furthermore, to expand the number of choices available to the experts, a five-point rating scale was used.

6. Survey data analyses and interpretation

Chapter 5 concerned the research design and methodology. The findings of the water experts' survey are presented in this chapter.

6.1. Data and method analysis

As stated, the questionnaire (see Annex B) consisted of five sections:

I. The Challenges and the Enabling Environment of Sustainable Water Resources Management (Q1 to Q6).
II. Establishing Governance and Institutional Framework (Q7 to Q15).
III. Management Instruments (Q16 to Q20).
IV. Water Infrastructure Development and Financing (Q21).
V. Outcomes and Impacts (Q22 to Q24).

The survey applied five-point rating scales for guiding the experts. The data analysis were conducted by using charts, graphs, and statistical tables. Furthermore, the survey results were triangulated with existing literature for further validation and to expand the outreach and transferability analyses.

6.2. Presentation of findings

The results of the water experts` survey and the information gained from the Syrian water experts were analysed. The presentation of this analysis is accompanied by an analysis of the related literature. Each is presented in relation to the research objectives:

(1) to define the challenges of the Syrian water sector and examine the existing enabling environment and its suitability for achieving sustainable water resources management;

(2) to evaluate the present governance and institutional framework of the Syrian water sector;
(3) to check the availability and estimate the degree of application of management instruments;
(4) to examine the ongoing process of development and financing of water infrastructure;

(5) to estimate the overall impact of water resources management on the economic, social, and environmental aspects.

Then, the water experts' responses and the related literature review were combined to test the research hypotheses:

(1) the enabling environment is suitable for ensuring sustainable water resources management in Syria;

(2) the current governance system and institutions are appropriate for properly managing water resources;

(3) the application of management instruments for enhanced decision making is improved;

(4) the water infrastructure is well financed;

(5) the overall impact of enhanced water resources management on the economic, social, and environmental aspects is positive.

6.2.1. General water experts' survey analysis

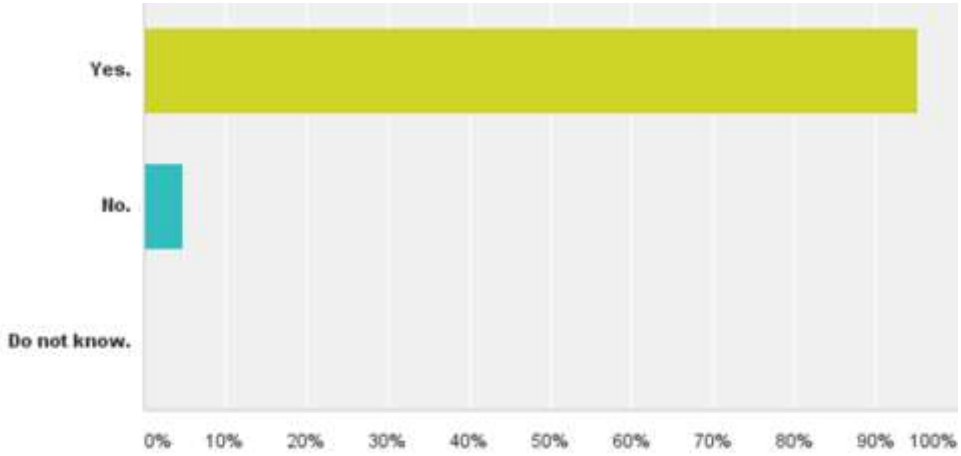
6.2.1.1 The challenges and the enabling environment of the water sector in Syria

The first section of this survey addressed the first research objective and had six questions (Q1 to Q6) focusing on the challenges of the water sector in Syria and on the existing enabling environment, which includes developing and applying the necessary policy, planning, and legal framework needed to guide and coordinate water resources management.

6.2.1.1.1. Water mismanagement

First, the water experts were asked to answer whether a general management problem exists in the water sector (Q1): Do you think that the water sector in Syria has a management problem? (see figure 20).

Figure 20- Water experts' views on the existence of water problems



The majority of the respondents agreed that there is a water management problem.

According to Salman and Mualla (2004), inappropriate water management decisions, poor planning, and policy failures have worsened these conditions. The Syrian Government used to afford large aids for the production of water-intensive agricultural yields, like wheat and cotton.

The irrigated agriculture needs to be modernized because of its dependence on flood and inefficient and traditional irrigation methods. The main source of irrigation is ground water, which is over pumped (Salman and Mualla; 2004), causing depletion of groundwater and increased production charges. Wada et al. (2012) determines that 78% of ground water withdrawal in Syria is over pumped, so the recharge rate cannot compensate for the pumped amount of water for irrigation.

Many examples from the literature reviews reflect the worsening conditions of the water resources in Syria. The similarity between survey results and findings from the literature confirms the reliability of the survey data. There is a management problem within the Syrian water sector, which needs to be addressed.

The second question (Q2) aimed to discover the major problems and challenges in the Syrian water sector by presenting a list of common and typical water challenges for the middle east region from the literature review where the experts were asked to mark the priority of answers (from 1 Low to 5 High). The results are presented in Table 3 below.

6.2.1.1.2. The challenges of the Syrian water sector

The second question (Q2) was the following: What are the major problems and challenges in the Syrian water sector?

The first challenge in the Syrian water sector is the limitation of water resources followed by excessive use of water resources, and then low water use efficiency and climate change and drought. The responses from the water experts are presented in Table 3.

Table 3- Water experts' views to the main challenges in the Syrian water sector.

	1	2	3	4	5	Befragte gesamt
Climate change and drought	**47,62%** 10	**28,57%** 6	**19,05%** 4	**4,76%** 1	**0,00%** 0	21
Limitation of water resources	**61,90%** 13	**28,57%** 6	**0,00%** 0	**9,52%** 2	**0,00%** 0	21
Exessive use of water resources	**61,90%** 13	**33,33%** 7	**0,00%** 0	**4,76%** 1	**0,00%** 0	21
Pollution of water resources	**19,05%** 4	**38,10%** 8	**28,57%** 6	**14,29%** 3	**0,00%** 0	21
Low water use efficiency	**57,14%** 12	**33,33%** 7	**4,76%** 1	**0,00%** 0	**4,76%** 1	21
Development of institutional structures of water bodies and authorities	**23,81%** 5	**38,10%** 8	**28,57%** 6	**4,76%** 1	**4,76%** 1	21
Absence of appropriate water management plans	**30,00%** 6	**45,00%** 9	**15,00%** 3	**10,00%** 2	**0,00%** 0	20
Competitive water use among the sector	**15,00%** 3	**25,00%** 5	**25,00%** 5	**30,00%** 6	**10,00%** 2	20
Shared international water resources	**23,81%** 5	**23,81%** 5	**23,81%** 5	**19,05%** 4	**9,52%** 2	21

Most water experts confirmed the listed problems and commented on this question to indicate additional challenges:

- Centralization of management process,
- Reduction in qualified scientific staff through increased immigration ratio since the crises in Syria (brain drain).

The need to manage water in an efficient way in Syria seems to be of a great importance from the point of view of Syrian experts, who provided rich answers representing serious worries concerning the different water management challenges in Syria.

According to Ker Rault (2008), open questions allow the facts delivered by respondents to lead to unexpected products, which exceed the original quality of facts (Ker Rault; 2008).

Although the water experts gave first priority to the limitation of water resources and ranked climate change third, the connection between these two challenges seems clear.

Water resources in Syria will be strongly affected by climate change, which will limit the surface and ground water by around 1300 MCM in 2050 and rise the evaporation from the water

surfaces by about 190 MCM. Proper management practices and improved sanitation and irrigation techniques will balance this water shortage (Mourad & Brendston; 2011).

Efficient water management practices will increase the volume of water available for human and food production uses. Saving water in irrigated agriculture can be realised by applying efficient irrigation techniques, like sprinkler and drip irrigation, which can save up to 30% of the irrigation water. Furthermore, the proper treatment of wastewater and its reuse in irrigating some crops will add a new source of water.

Due to developing population, growing water consumption for drinking and household purposes, and the growing food demand Syria had to apply compulsory procedures for sewage water treatment and agricultural water reuse. In recent years, the government realized a wide-ranging program to create wastewater treatment plants in all provinces. Locally assessed treated sewage water reaches 350 million m^3/year arising from treatment stations in Damascus, Aleppo, Homs, and Hama. The amount of treated wastewater could increase up to 500 million m^3 after the accomplishment of treatment stations. The expansion of the existing wastewater plants is planned by relevant technical studies (Kaisi et. al; 2004).

Generally, both the water experts and the literature review confirm the vulnerability of the Syrian water sector to the typical Middle East region challenges.

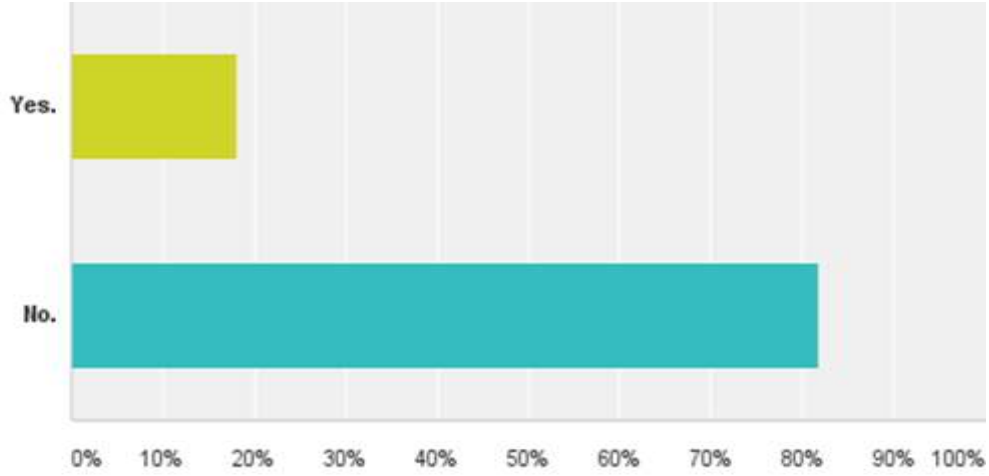
To deal with these challenges, appropriate policies, planning, and legal framework are needed. Thus, the Syrian water sector must focus on the existing enabling environment of sustainable water resource development and management.

6.2.1.1.3. Adequacy of the existing water policies, legislations, and strategic plans

Questions 3, 4, 5, and 6 investigated the adequacy of existing water policies, legislations, and strategic plans of the Syrian water sector. These questions determined the reasons for and presence of needed management tools and plans and international agreements on shared water resources. Question 3 was as follows (Q3): Do you consider the current water policies, legislations, and strategic plans as being suitable for managing the water resources properly?

The survey (Figure 21) indicated that most participants were not satisfied with the existing water policies, legislation, and strategic plans of the water sector.

Figure 21- Water experts` views on the suitability of existing legislative framework

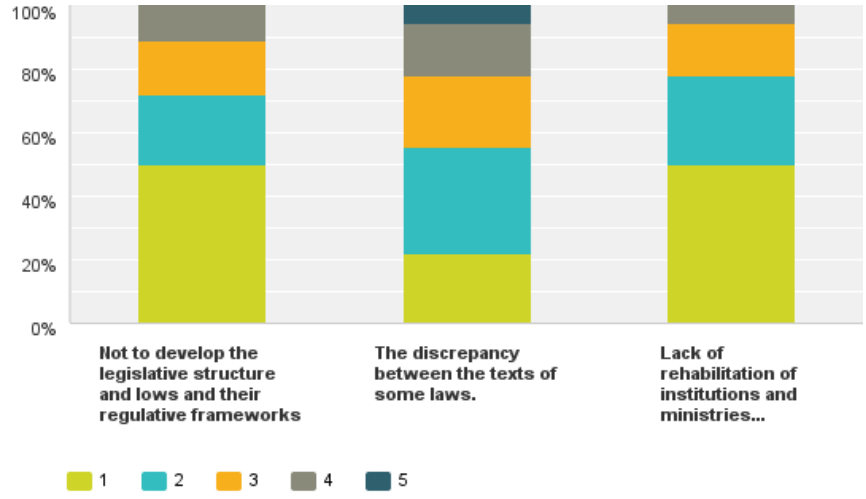


The next question (Figure 22) addressed the causes of the inadequacy of current water legislation and laws for the sustainable water resources management (Q4): What are the reasons for the inadequacy of current water legislation and laws for the sustainable water resources management? (please mark from 1 low to 5 high).

The choices were three reasons from literature review:

- The lack of rehabilitation of institutions and ministries structures,
- The undeveloped legislative structures,
- The laws and their regulative frameworks (Daoud; 2013; in Arabic).

Figure 22- Water experts' views on the inadequacy of current water legislation



All three items were supported by most of the respondents, and some experts provided additional comment:

- Development of the executive frameworks not just legislative structure.
- Lack of coordination between Ministry of Water resources and Ministry of Agriculture. Comparative advantages of producing crop are not adopted in the agricultural planning process.
- Lack of qualified decision makers and scientific experience how to build the adequate plans to profiteering the water and lake of the programs (software and hardware)
- Unrestrained law.
- The absence of law enforcement.

The literature review indicates that the irrigated agriculture has increased steadily in Syria since 1985, aiming to achieve food safety policy goals to meet the food production needs of growing population (Hadddad, 2008; Kaisi, 2007; Daoud, 2013; Mourad & Brentsson, 2012; Barnes, 2009).

Francesca de Chatel argued that not the water scarcity, but almost the government failure to manage water and land resources is the cause of the current water crisis in Syria. The Syrian water policy has been, like many countries in MENA region, supply driven since 1950 and focused on dam construction and large irrigation projects in the north-eastern region of the state. The severe growth in agricultural production and expansion of irrigated agriculture blended policy makers to natural capacity of the countries resources (De Chatel; 2014).

Syrian water experts' comments suggest the same direction noted by the literature review: the deficiency in the application of laws from the executive authorities in the water sector, potential of decision makers to updating laws, and the lack of coordination between the different water directorates in the ministries.

Then, the survey explored the existing plans and strategies in the Syrian water sector, which govern the process of sustainable development: The degree to which water is incorporated in the several planning official papers initiated at national or local level is an indicator of the adoption of integrated approach.

Poverty reduction strategies, National Strategy for Sustainable Development, and National Environmental Action Plan are three of the most widely considered plans (UN Water Report; 2012).

The fifth question was stated as follows (Q5): Do these policies and legislations include any tools and plans, which may incorporate water resources management? (Figure 23)

According to the Syrian national policy, the main strategies, programs and plans which have been adopted within the framework of the successive Five-Years Plans are:

- The national framework strategy for sustainable development,
- The national environmental strategy and action plan in Syria,
- The initial national communication on the UN Framework Convention on Climate Change,
- The national strategy and action plan for the adaptation to climate change in Syria (Syrian National report; 2012).

About half of the participants considered the Syrian national water policy underdeveloped, while one-third thought it was developed but its implementation had not yet started.

Concerning the IWRM water efficiency plan of Syria, more than half the participants considered the plan underdeveloped, while some experts said it was developed but not implemented, and only a few thought implementation had begun.

Most of the interviewed water sector experts thought that the land and water resources plan was underdeveloped and only some said it was developed but implementation had not yet started.

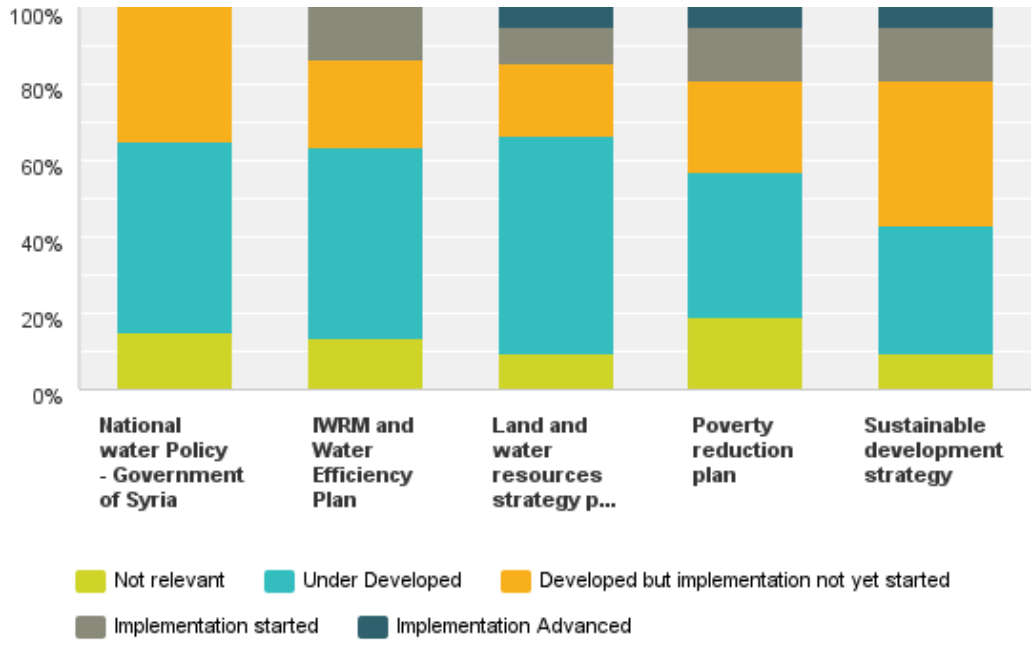
The poverty reduction plan was underdeveloped, according to many of the participated water experts, and some thought it was developed but not yet implemented.

The participants mentioned the following additional plans:

- Sustainable water use plan in the agricultural sector.
- A strategy introduced by the Higher Commission for Scientific Research application of which, due to the current situation in Syria, is very limited.
- There is a plan for improving the water users' associations but still not developed because there are no clear plans to develop the admixture of the responsible authorities.

Many participants believed the sustainable development strategy was developed, but some thought it was underdeveloped.

Figure 23- Respondents` views on the main plans in the Syrian water sector



According to the United Nations' estimations, due to the importance of water resources and their conservation, the Syrian government has conducted a series of actions to achieve the sustainable development of water resources:

- The National Water Strategy in the framework of modernizing the water sector,
- The National Water Low (No.31) Government of Syria 2005,
- IWRM and Water Efficiency Plan, which was moderately applied (UN Water; 2008).

Therefore, the government has developed several procedures; the most important of which are as follows:

- Enacting Syrian water legislation by Law N /31/ for the year 2005,

- Enacting Environment Protection Law N /50/ for the year 2002, on which the water act has depended for pollution control,

- Creating the Irrigation Development Fund according to the Decree N /91/ for 2005,

- Founding a Special Administration for Irrigation Development Fund in accordance with Resolution N /2817/ for 2005,

- Creating a higher committee for fund management and producing instructions on government's contribution to irrigation development process by giving grants by water source (Kaisi; 2010; in Arabic).

One rich answer obtained from this question mentioned the National Policy for Science and Innovation of Syria, newly introduced by the Higher Commission for Scientific Research in 2012. However, the application of this policy, due to the current situation in Syria, is limited. This strategy aims to assemble the work of the national teams of researchers and learners in the various economic and developmental sectors and to summarize the national policy for science, technology, and innovation in Syria.

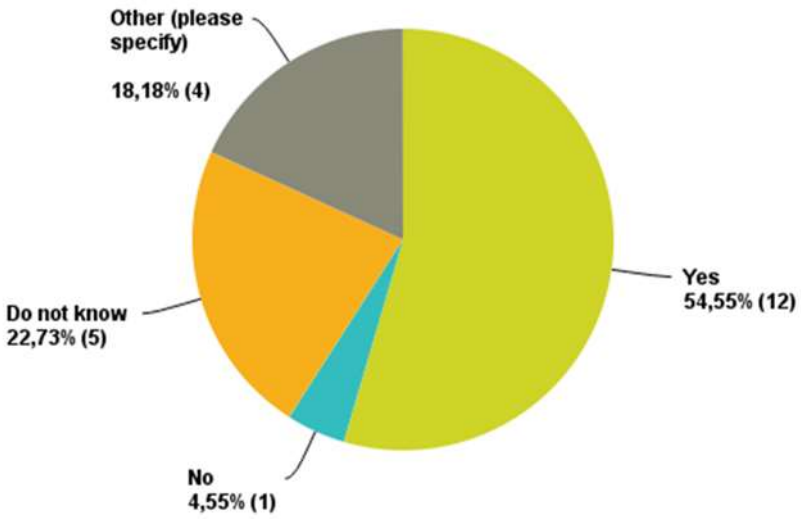
Furthermore, the National Policy for Science and Innovation of Syria so explains the national desire to move toward a knowledge economy and invest in the outputs of scientific knowledge, technology, and innovation in the process of sustainable development (National Policy of Syria; 2012; in Arabic).

Concerning the inclusion of needed management tools and plans, Syria made achievements in the first ten years of the new millennium, but there are still some obstacles on the way of achievement of MDGs, especially with respect to climate change and its impact on the developmental efforts in poverty reduction and environmental sustainability (third national progress Report; 2010). Both the literature review and the survey results (Figure 3) indicate the same results: most water sector development plans are under-developed.

The last question in this first section of the survey (Q6) concerned the status of existing international agreements on shared international resources as an essential part of enabling sustainable water resources management: Are there any international agreements on shared water resources management? (Figure 24).

The surface water and groundwater resources in Syria have either been exploited or will be exploited in the nearby future. The development of the water resources in Syria is linked to available water resources, especially the share of water from the international common water resources from common rivers. Syria signed different agreements with all the riparian countries: Turkey, Iraq, Jordan, and Lebanon. The Syrian attitude toward common waters is to reach fair and equitable water sharing among riparian countries and prevent sewage water and drainage water disposal by neighbouring countries through a good-neighbour policy (Kaisi; 2007).

Figure 24- Experts` views on the international agreements



To this question, more than a half of the participants answered 'Yes', many answered 'Don't know' and only 5% answered 'No'.

Some water experts commented to this question:

- 'I think there is no agreement, but memorandum of understanding'
- 'Between Syria and Turkey but unfortunately it is still not clear or fair'
- 'There is agreements with neighbouring countries, Turkey, Iraq, Jordan and Lebanon, which is affected in the practice by the political, climatic, and demographic circumstances'.
- 'Unfair agreement'.

The varieties between the answers indicate a low level of engagement in trans-boundary agreements.

According to the report of the water resources sector in Syria, for further development of water sector international rivers, especially Euphrates, should be monitored in terms of changes in quantities and qualities of water. It is necessary to conduct new evaluation of the expansion of exploitation in the upper basins and reflections on the discharges and productivity and water requirements for crops (Water Resources Sector Report; 2011). Undoubtedly, there is a need to develop a system of global law and to regulate the management and exploitation of integrated water resources by consensus with other riparian states and to promote the joint cooperation in shared water resources and capacities to apply this kind of agreement.

According to the Initial National Communication of the Syrian Arab Republic, the local and international researchers, working in the field of ground water investigation in Syria, suggested several methods to harness the impact of climate change according to philosophy of IWRM, such as:

- Formulating a general water master plan within the agenda of IWRM and incorporating water plans and strategies linked to water usage,
- Implementing laws and guidelines, including spring security areas, well boring approvals, drilling observation and specifications, safeguarding of groundwater renewal zones, groundwater extracting systems, securing groundwater and surface from contamination, and development of water resources,
- Improving the efficiency of irrigated agriculture by minimizing water demand for irrigation through variations in the cropping schedule, crop combination, irrigation technique, and planted zone (INC; 2010).

Syria`s water resources are becoming progressively limited as future demand is coming close or even exceeding available water resources. Later, the efficiency of water use in all sectors is becoming a problem of concerned sectors (economic, social, and political), and water policies are at the centre of the nation's economic policy consultations (Haddad; et. al; 2008).

The Syrian government, aiming to enable an environment of sustainable water resources management, tried to implement several measures in its water policy and laws, but the implementation of these water policies is a slow process.

6.2.1.2. Establishing governance and institutional framework

The second section of the survey addressed the second research objective and included nine questions (Q7 to Q15) about establishing governance and an institutional framework: the political, social, economic, and organizational systems required for managing the improvement and use of water resources.

6.2.1.2.1 The adequacy of the current institutional framework

The survey's questions were designed to gain insight into the existing water governance system in Syria. Thus, question 7 (Q7) was the following: The existing institutional framework in the Syrian water sector is suitable/not suitable for achieving sustainable development because it contains the necessary management mechanisms. (See Table 4 and Figure 25).

The basic idea of IWRM is to start from the lowest appropriate level, which means taking the basin approach. In this approach, decentralized decision making can occur based on the active involvement of stakeholders. The necessary mechanisms to consult the shareholders on all

spatial levels (basin, province, and municipal levels) should be established to realize the participation of all concerned classes. Participation does not only mean raising awareness and building confidence and education, but also finding economic resources to facilitate membership and acquiring good and transparent centres of information.

The proper water management requires the introduction of significant changes to the development of water institutions and adjustments to their framework and terms of reference and modernization of the legal framework to cope with IWRM concepts. Therefore, effective mechanisms for coordination between the institutional bodies concerned with water should be established and the principle of participation in the preparation of plans, programs and development, implementation, and follow-up should be activated (UN Water Report, 2012; Abed-Rabbouh; 2013 in Arabic).

The existing institutional framework for managing water resources is not suitable for dealing with the water sector's challenges or for developing and applying the adequate mechanisms for effective dialogue, consensus building, and stakeholders' involvement in planning, management, and decision-making processes.

The deficits in the current institutional framework have led to the following:

- Limited integration of holistic basin-wide planning and management,
- Overlapping roles and responsibilities between ministries and water authorities, causing inefficient use of investments and human resources and gaps in effective management,
- Improper cross-sector water management between various water authorities,
- Lack of participation and awareness building between stakeholders and water institutions and authorities,
- More centralized decision making in water management (Water Strategy of Syria [2002]; Water Strategy of Jordan [2016-2026]).

Question 7 (Q7) aimed to specify the existing water management mechanisms within the water sector in Syria, to evaluate the status of the application of these management mechanisms, and to discover the deficits of the application and the needed development. Responses are presented in Table 4 and Figure 25.

Table 4- Water experts' views on the existing mechanisms in the water sector in Syria.

	Not Relevant	Under Development	Developed but Implementation not yet started	Implementation started	Implementation Advanced	Gesamt	Gewichteter Mittelwert
Mechanisms (e.g. commissions, councils) for river basin management	**0,00%** 0	**61,90%** 13	**19,05%** 4	**19,05%** 4	**0,00%** 0	21	2,57
Mechanisms for management of groundwater	**15,00%** 3	**55,00%** 11	**25,00%** 5	**5,00%** 1	**0,00%** 0	20	2,20
Mechanisms for cross-sector water management	**25,00%** 5	**50,00%** 10	**20,00%** 4	**0,00%** 0	**5,00%** 1	20	2,10
Mechanisms for trans-boundary water management	**5,26%** 1	**78,95%** 15	**5,26%** 1	**0,00%** 0	**10,53%** 2	19	2,32
Mechanisms for stimulating the participation	**52,38%** 11	**33,33%** 7	**9,52%** 2	**4,76%** 1	**0,00%** 0	21	1,67
Decentralized structures for water resources management (other than above)	**60,00%** 12	**25,00%** 5	**10,00%** 2	**5,00%** 1	**0,00%** 0	20	1,60

Figure 25- Water experts` views on the existing mechanisms in the water sector in Syria

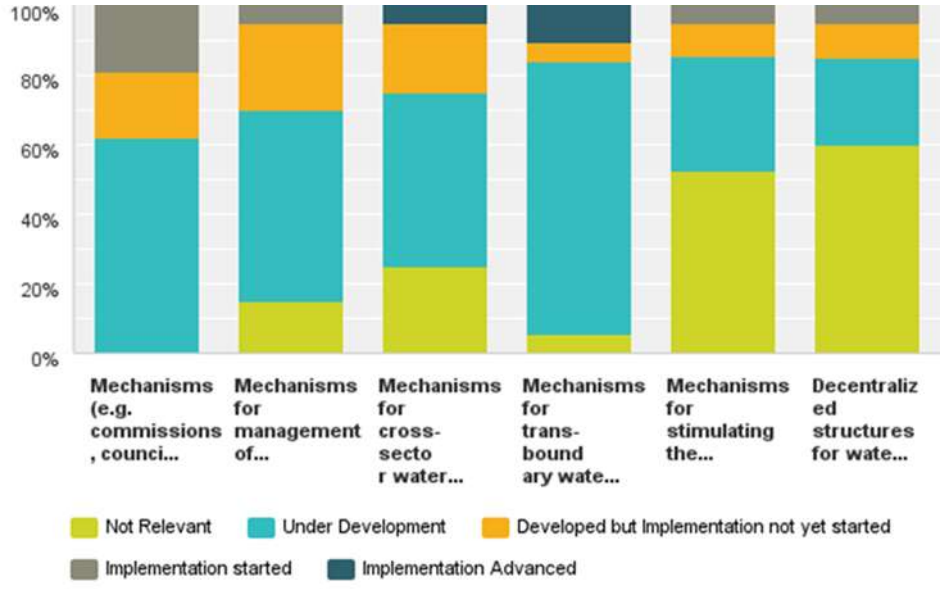


Figure 25 illustrates that all participants believed there is a mechanisms (e.g., commissions, councils) for river basin management in the Syrian water sector, but the majority thought that

they were under developed, while only a few believed these mechanisms were developed but not yet implemented.

Concerning the mechanisms for management of groundwater about half the participants reported that mechanisms for management of groundwater
are underdeveloped, while the rest had various opinions.

The survey indicated that half the water experts considered the mechanisms for cross-sector water management are underdeveloped, while some believed it did not exist, and the minority considered this management mechanism developed but not yet implemented.
Regarding the mechanisms for trans-boundary water management the majority of the participants reported that this mechanism was underdeveloped, and only a few considered the implementation advanced.
For the mechanisms for stimulating participation half of the experts said that those mechanisms are not relevant, while some considered them underdeveloped.
There is an urgent need to apply the mechanism of effective water users' participation in providing water supply and wastewater discharge services to guarantee the obligatory involvement of the stakeholders in the planning and development of schemes by establishing these mechanisms; increasing the awareness of their role responsibilities; and encouraging dialogue between stakeholders, private establishments, and public organizations. Meeting the criteria of effective public participation is essential. These criteria include (see Section 3.3.4.3.4) the following:

- the public must be involved early in the planning and design stages of the water management project,
- there must be representation and access to related information,
- there must adequate information exchange, the decision-making process must be improved,
- the process must be educative and engender negotiations.

The concept of public participation was highlighted in question 10 of the survey.

Concerning the decentralized organizations for water resources management, figure 25 indicates that the majority of the participants considered the decentralized structures irrelevant to the Syrian water sector, while a few stated they were underdeveloped. Therefore, the existing decentralized institutions are newly established and still function in a centralized manner because the new water legislation itself is highly centralized and the mechanisms of public participation that encourages bottom-up decision making are absent or under development.

In the next question, the survey focused more deeply on the decentralization.

In their comments, the experts mentioned other existing mechanisms:

- Mechanism for protecting the water resources from pollution, which is developed but the implementation not yet started.
- Water saving mechanism on the farm level that is underdeveloped.

The Higher Council of Environment Protection was created to deal with environmental issues. The council is characterized by developed legislative framework and aims to increase the coordination between different bodies and agencies concerned with the environment at the planning and implementation levels. In addition, the council strengthens the role of Ministry of State for Environment Affairs to support the executive authorities by using the multi-sectoral approach to environmental issues (Syrian National Report; 2012; in Arabic).

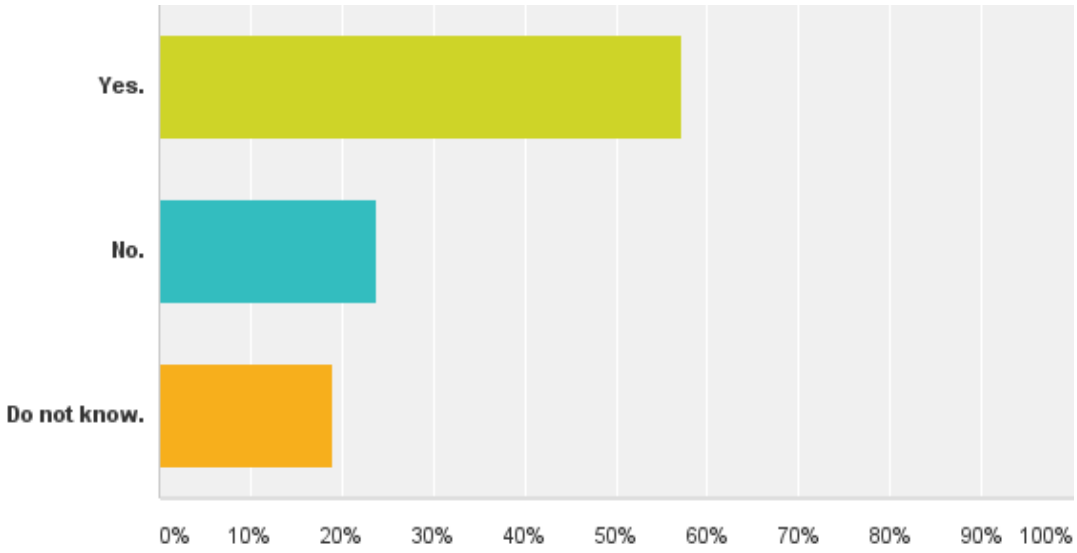
Regarding the existing institutional framework in the Syrian water sector and its suitability for targeting sustainable development, the survey results and the literature review both indicted that this institutional framework does not match the requirements of sustainable water resources management. Furthermore, it is necessary to renew the institutional framework based on autonomous basin level organization, develop new cross-sector water management mechanism by reviewing related current policy and legislative regulations to eliminate probable duplications, and to improve the involvement of water users in the management process and formulation of decentralized decision-making.

6.2.1.2.2 Decentralization within the Syrian water sector

The next survey section gained further perceptions from the respondents on the concepts of decentralization and public participation in water management process in Syria and evaluated their role in facilitating the planning and execution of water projects.

Decentralization in the water sector management forms an appropriate institutional framework that helps activate participation at the local level or at the level of the water basin management. Furthermore, decentralization facilitates decision making at all levels and in the creation and development of policies and operational plans, as well as in the management and implementation of outreach programs and the rationalization of consumption at the local level. Thus, the eighth question (Q8) was the following: Can the decentralization in managing the water sector be like an institutional framework, which enables the participation on the basin and local level?

Figure 26- Water experts' views on the role of decentralization in enhancing participation in the water sector in Syria.



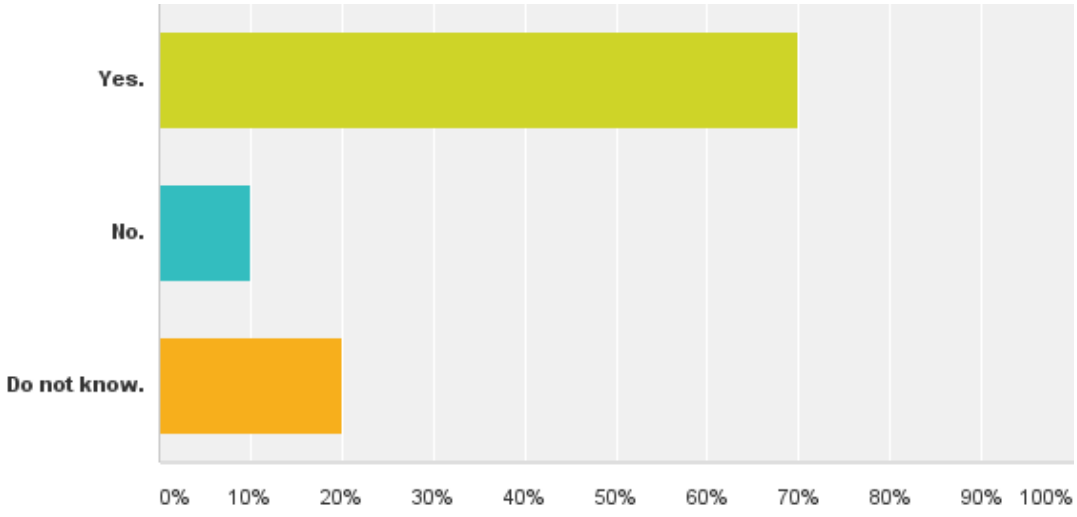
The majority of respondents believe that decentralization can enhance participation in the water sector, but the rest were either against or not familiar with this newly introduced administrative system.

According to Nikolov (2006), one of the most general definitions of decentralization is that 'it is a process through which authority and responsibility for public functions is transferred from the central government to local governments, civil societies and other non-government organizations'. The UNDP definition of decentralized governance as 'a systematic and harmonious interrelationship, resulting from the balancing of power and responsibilities between central governments and other levels of government and non-government actors, and the capacity of local bodies to carry out their decentralized responsibilities using participatory mechanisms' (Nikolov; 2006; P: 3).

Whether the strong centralization of water management in Syria has caused a reduction of effectiveness in the local water authorities regarding decision-making is unclear (INECO; 2009). The reviewed literature indicates decentralization is still a matter of discussion within the Syrian water sector. Decentralization can play an essential role in expanding the participation in political, economic, and social activities (see Section 3.3.4.2).

Question 9 (Q9) evaluated the role of decentralization in facilitating planning and execution of water- related projects: Can the decentralization facilitate the planning and executing of water projects?

Figure 27- Water experts' views on the role of decentralization in facilitating planning in the Syrian water sector.



Most participants thought that decentralization could facilitate planning and executing; only a few were against this idea, and some answered 'Don't know'.

Some participants commented on this question:

'Yes, but only if involving the central plan and compatibility with other cities. Therefore, there must be an overall national strategic plan, and the plan at the provincial level to be implemented in the form of subsequent implementing schemes'.

Some water experts were self-resistant when discussing decentralization since the modern concept of decentralization was newly introduced to the Syrian system. In many cases, this concept could be understood negatively as a complete separation from the central administration in the ministry.

The reviewed literature (see Section 3.3.4.2) implies that taxation, payments, and supervisory tasks should be executed by lower levels of government unless the central government can make a convincing case for nominating itself. Arguments for keeping the power should be made based on comparative efficiency.

Generally, the majority of the respondents agree with the advantages of decentralization, but there was misunderstanding of the concept of decentralization and lack of experience with decentralized water projects.

The discussion of the positive role of decentralization in water management in led to examining the concept of public participation in the water management process in the next question

6.2.1.2.3 Public participation in water management process

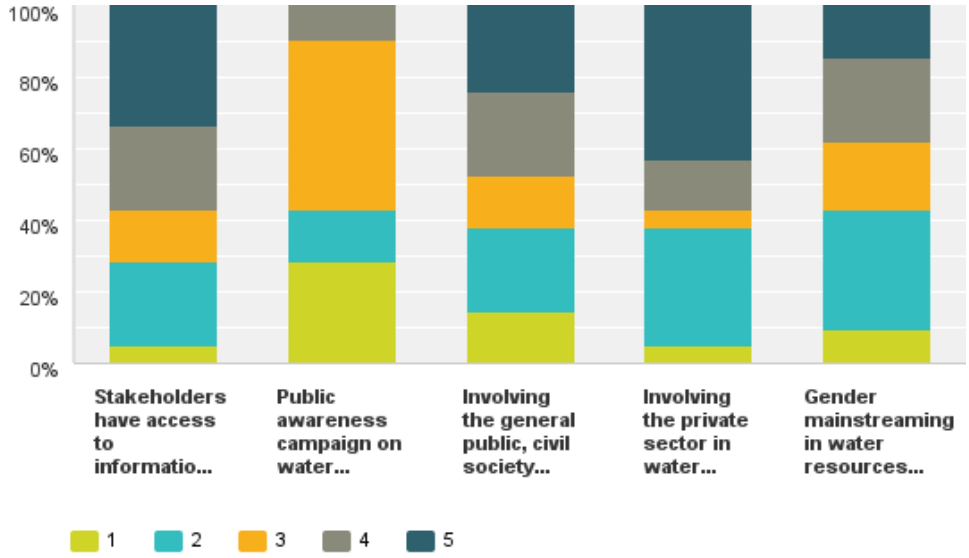
Participation can be used to achieve an appropriate balance between the lowest and highest levels of the pyramid (from top to bottom and from bottom to top) for the IWRM (GWP; 2000). Informed decision-making and stakeholder involvement requires access to relevant information on water management issues. Facts about water in Syria were disseminated to highlight the costs of water availability and the increasing pressure on water resources to enhance the knowledge base and inform the decision-makers and the general public (INECO; 2009 & Water Strategy of Syria; 2003).

The methods of cooperation between water authorities and stakeholders in Syria were evaluated by water experts as follows:

- Allowing stakeholder access to information concerning the management of countries' water resources,
- Arrange public awareness campaign on management of water resources and development,
- Involving the citizens, civil society establishments, and non-governmental societies in managing water resources at basin level,
- Involving the private sector's enterprises in water resources management and improvement at the water basin level,
- Increasing women involvement in managing water resources and development (UN Water Report; 2012) (see Figure 28).

Thus, question 10 (Q10) was as follows: What are the ways of cooperation between the responsible water bodies and authorities and stakeholders? (Please mark once from 1 the most right to 5 the least right).

Figure 28- Experts' views on the cooperation methods with stakeholders



Regarding the stakeholders' access to information on national water resources management, the respondents gave different answers to this part of the question. Some experts believed the stakeholders did not have the needed access to the information on national water resources, while others thought that the stakeholders were well informed about the water resources. The rest were unsure about the availability of the information. Figure 28 illustrates that not everyone had the needed access to information on national water resources.

Informed decision-making and stakeholder involvement requires access to relevant information on water management issues. Facts about water in Syria were disseminated to illustrate the costs of water availability and the increasing pressure on water resources to enhance the knowledge base and inform the decision-makers and the general public (INECO; 2009; Water Strategy of Syria; 2003).

Concerning the public awareness campaign on water resources management and development, Figure 28 indicates that about half the participants were unsure about the application of this kind of cooperation through public awareness campaigns. Many of the participants agreed with the statement, and only a few disagreed.

Public awareness campaigns on water resources management are being implemented properly, but it is still necessary to maintain and expand them in the local and national media. Providing educational programs to the public about the significance of water and for the welfare of the country to targeting sustainable economic and social development and about the fact that water is a rare and valuable resource, in combination with improving the transparency between the

water users and decision makers, will support the future implementation of the aims and plans of the national water strategy.

About involving the general public, civil society organizations, and non-governmental organizations in managing water resources at the water basin level, about half of the participants indicated the existence of this involvement in the water resources management, but the other water experts slightly disagreed with this statement. Thus, there is a moderate level of involvement of the general public, civil society, and non-governmental organization in water resources management at basin level.

The survey results indicate that the engagement of the general public, civil society associations, and non-governmental associations in formulating efficient stakeholder participatory water management approaches is acceptable, but there is a need for further exploration about the nature of this involvement and how it can be more effective in influencing decision making regarding sustainable development.

Regarding the contribution of private sector in water resources management and development at the basin level, the majority of the participants indicated that the cooperation between the responsible water bodies and authorities and stakeholders is through the involvement of the private sector, but others disagreed with this statement.
The concept of public private partnership in water management was addressed in next survey questions (Q11, Q12, Q13, and Q14).

Concerning gender popularisation in water resources management and development:
According to Kaisi (2005), although Syrian women have gained many rights, they are still far from achieving development compared to woman in developed countries. They do not participate in decision-making processes and program planning. The heavy load on women in water intake management under shortage conditions highlights the gender concerns in farming and rural development concerning healthiness and safety of household companions or food safety. This situation also underlines the related effects on state economy and environment or women discrimination in terms of poverty. The involvement of woman in water resource management is essential to recover both women's position and the active use of the limited water resources for current and upcoming generations (Kaisi et. al; 2005).

Figure 28 indicates that the participants' opinions are different regarding cooperation between the responsible water bodies and authorities and stakeholders. Some participants believed that

the women were involved in the water resources management and development; others did not support this statement, and the rest were unsure.

The understanding of gender implications for water management must be increased through capacity building. The women participation is decision making process will improve the decision making.

Some participants commented on this question by suggesting additional methods of cooperation with the stakeholders, like empowering the water user associations (WUA) and reducing the water using costs.

According to Hübschen (2011), the public sector is in charge of the operation of water facilities. The private sector and the civil society have limited levels of membership in the water sector (Hübschen; 2011). The domination of the public sector on water supply development and services delivery is obviously clear in Syria. The involvement of private sector can improve the efficiency and effectiveness and enhance the development and sustainability of water services.

In the Tenth FYP (Five Year Plan) and in the national water strategy plan, the Syrian government recommended increased cooperation with private sector to intensify the financial effectiveness of the water supply and wastewater treatment (SAR: Tenth FYP). The expansion of the private sector role through management contracts in some utilities will be considered and the encouragement of private participation in irrigated agriculture will be encouraged. Social benefits of private investments will be emphasized (Water Strategy of Syria; 2002).

Regarding methods of cooperation between the responsible water bodies and authorities and stakeholders, the data suggests that the cooperation process was ineffective. Nevertheless, one cannot generalize and consider the entire cooperation weak; not all methods cooperation were estimated negatively. For example, concerning the methods of cooperation with stakeholders, the experts indicated there is a moderate level of involvement of the general public, civil society, and non-governmental organization in water resources management at the basin level and a moderate level of involvement with private sector.

More engagement of the general public, civil society associations, and non-governmental associations are needed to formulate efficient and acceptable participatory water management approaches. The access to related information on national water resources management issues should be given to all stakeholders. The public awareness campaigns on water resources management are not being implemented properly and need to be expanded into the local media and national media. Conducting educational programs for the public about the significance of

water and for the welfare of the country to targeting sustainable economic and social development. Gender mainstreaming should be improved through appropriate policy and guidelines that enable women and men to have equal opportunities in resources allocation and management and to share their views and reservations in decision making.

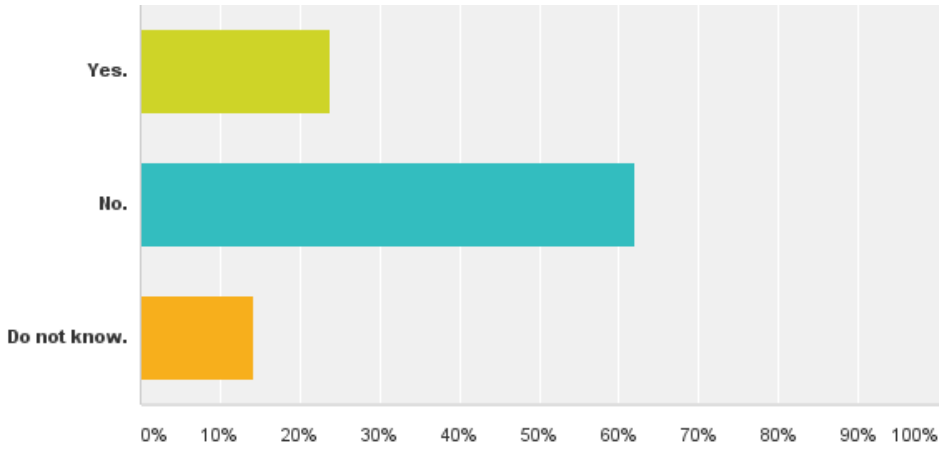
6.2.1.2.4 Private sector participation in water management

Questions 11, 12, 13 and 14 were designed to gain a deeper understanding about the role of private sector participation in water management in Syria.

Question 11 (Q11) asked the respondents about the probable privatization of the water sector: Do you consider the privatization of the water sector as a good option for achieving better water resources management?

Most of the participants did not think that the privatization of the public sector was a positive option, as Figure 29 illustrates.

Figure 29- Experts` views on private sector participation in water management



Second, the next two questions addressed the advantages and disadvantages of private sector participation in the water management process.

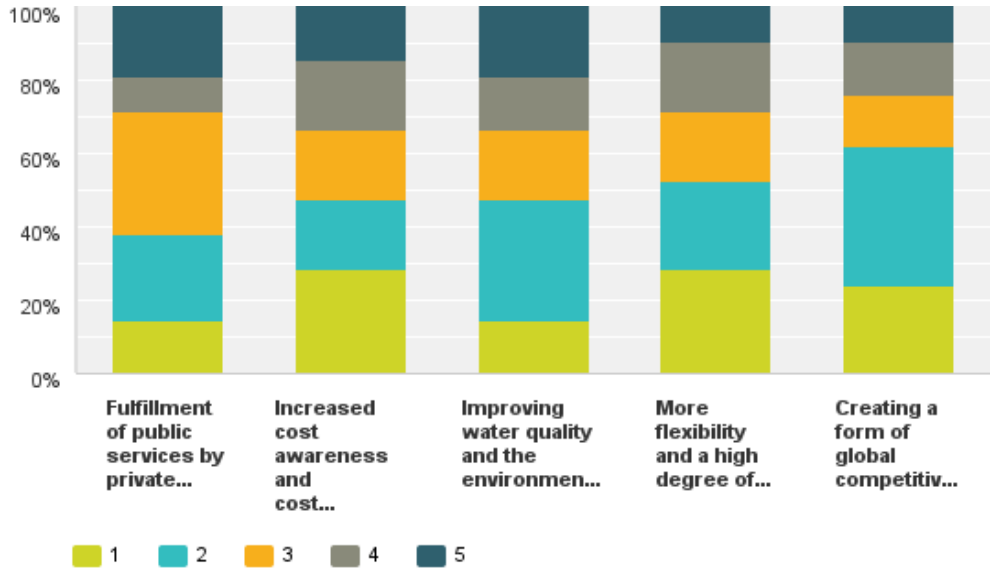
According to the reviewed literature (see Section 3.3.4.4), the participation of the private sector in the water supply is assumed to provide a number of advantages:

- Fulfilment of public services by private investments,
- Increased cost awareness and cost transparency,
- Improved water quality and environment through technology,
- More flexibility and increased objectivity by higher economic and organizational independence,

- A form of global competitive business units that operate their services more efficiently (Besche; 2004).

Thus, question 12 (Q12) was as follows: Do you agree that the privatization has following advantages? (Please mark from 1 the most right to 5 the least right).

Figure 30- Experts' views on the advantages of privatization



Regarding the fulfilment of public services by private investments, Figure 30 illustrates, about 40% of the participants agreed with this statement, while 30% were unsure and the rest did not agree.

This wide diversity in the answers can be explained by a lack of familiarization with the role of the private sector.

About the increased cost awareness and cost transparency, about half of water experts agreed with this statement, about 30% disagreed, and 20% were unsure.

Concerning improving water quality and the environment through the technology, nearly half the experts agreed that private sector participation can contribute to the improvement of water quality by utilizing the newest technology.

Concerning more flexibility and increased objectivity by higher economic and organizational independence more than half the participants supported this statement, while only a few disagreed. The rest were unsure

Regarding creating a form of global competitive business units that operates its services more efficiently, most experts agreed with this advantage of privatization and only a few disagreed.

Some participants commented on this question: 'that the privatization is good but not for the time being during the Syrian crises. Because of the higher rates of corruption nowadays than before so the poor people will not get any benefit from it'.

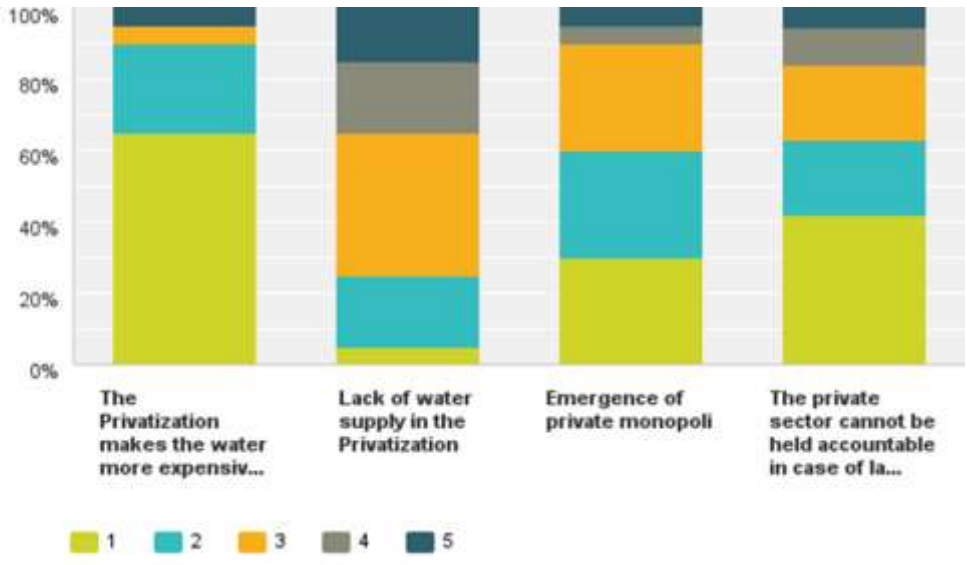
Although the respondents' views were diverse regarding the advantages of PPPs, many participants recognized the advantages of privatization. The prevailing conviction that water as a basic need for human life should not be controlled by profit-oriented companies is the reason for their attitude toward privatization of water.

The next question (Q13) estimated the experts' attitudes toward and perceptions of the disadvantages of privatization within the water sector, as presented in Figure 31: Do you consider that the privatization in water sector has disadvantages: (Please mark from 1 the most right to 5 the least right).

According to the reviewed literature (see Section 3.3.4.4), the participation of private sector in the water supply is assumed to provide a number of disadvantages:

- More expensive water: up to 20% as observed from some failed privatization experiments worldwide,
- Lack of water supply,
- Emergence of private monopolies,
- The private sector cannot be held accountable for implementing services (Kappel and Schmid; 2007).

Figure 31- Experts' views on the disadvantages of privatization



Regarding privatization makes the water more expensive, Figure 31 indicates that up to 20% as observed from failed privatization experiments, the majority of the participants believe that privatization will increase the price of water.
Concerning lack of water supply, again there was a wide diversity in the answers, which can be explained by the absence of familiarization with the PPPs experiments.
About the emergence of private monopolies, most participants believed that privatization will lead to the emergence of private monopolies; only a few of them do not agree.
Regarding the accountability of private sector for lack of implementation of the services, this point also was assured by most water experts.

The additional comments to this question were as follows:

- Removal of the sector support;
- There is no legislations can control this issue to protect the public, it is occasionally changeable; (no guarantee for the general public);
- Privatization in countries with high rate of corruption is a dangerous tool.

According to Van den Berg (1997), privatization of the water sector in England and Wales, one of the major recent privatizations of water sectors, delivered an impressive volume of new investments, higher drinking water standards, and more transparent water pricing systems. However, this experience expresses some teachings about the material needed to establish effective regulatory frameworks for the private investor. The general public resisted the increasing price of water caused by privatization due to higher operation costs. The regulatory system became more exposed to political interference. A lack of coordination was identified between economic regulation of private sector companies and governmental water management policies, which supports lower-income people (Van den Berg; 1997).

The participants' attitudes about the disadvantages of the privatization are based on the high rate of corruption and deficits in the legal framework of the Syrian water sector. These issues regulate the relationships between public and private sector. In addition, an absence of successful privatization experiments in providing water supply and wastewater services also influences the respondents' attitudes toward privatization.

Neither the reviewed literature nor the survey results imply a complete privatization of the water sector Syria.

Nevertheless, one can still examine the possibility of private sector contribution in managing water in Syria by suggesting a suitable form of cooperation or partial involvement of the private sector within the Syrian water sector.

To close this series of questions, question (Q14) highlighted the potential cooperation between public and private sectors: Can the public and the private sectors cooperate in managing the water resources?

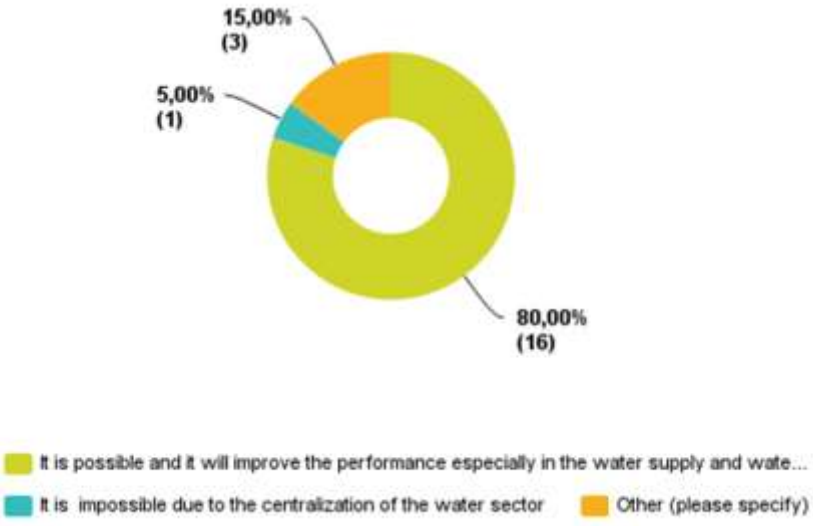
The survey indicated (Figure 32) that the majority of the participants thought that the cooperation between the public and private sector was possible and would improve performance, especially in water supply and water treatment. Only a few disagreed with this statement or were unsure.

Participants added the following:

- This issue is very complicated and sensitive due to the water scarcity in Syria and needs intensive researches for finding out optimal solutions.
- Possible, but with a real and transparent monitoring to ensure the quality of work.
- Do not know.

The survey results suggest that the privatization of the water sector is not recommended due to the current situation in Syria and to the high corruption rates. However, cooperation between the public and private sector in the field of water supply and water treatment seems to be beneficial for improved water resources management.

Figure 32- Experts` views on the cooperation between public and private sector in water management



Furthermore, the majority of the respondents accepted the enhanced contribution of the private sector, as a means to rise the efficiency of the provision of water services, as well as flexibility and organizational independence. Despite this experts' attitude, it is insisted that any form of cooperation with private sector companies should be compatible with the shape of public private partnerships with a real involvement of the state, closely monitoring and regulating all relevant operations.

Management contracts in some water utilities, dealing with water supply and wastewater treatment, in Syria could be the most appropriate form of cooperation with private sector since the possession of the object and obligation for the service delivery remains with the government. The private sector's responsibilities' are limited to specific services and the sector does not have to consider commercial risks. The weak regulatory framework in Syria is incompatible for closing such forms of cooperation with the private sector, such as concession or BOT.

Literature review and the survey results indicate future steps for more effective PPPs in the Syrian water sector:

- Raising public consciousness of the aims and potential profits of private sector partnerships,
- Developing an enabling institutional framework for enhanced PPPs, considering legal recognition and incentives,
- Promoting local private sector participation,
- Assessing sustainable development impacts in terms of poverty reduction and establishment of social equity.

6.2.1.2.5. Capacity building

The next question (Q15) investigated the process of capacity building within the water sector in Syria according to measures adopted by the Syrian water strategy and the national policy for science, technology, and innovation: The capacity building process in the water sector of Syria is taking place according to the following measures: (please select from 1 to 5, where 1 high and 5 low).

The process of institutional development and capacity building is considered one of the most important factors for achieving the national policy goals in scientific, technological, and innovative development (National Policy of Syria, 2012, in Arabic).

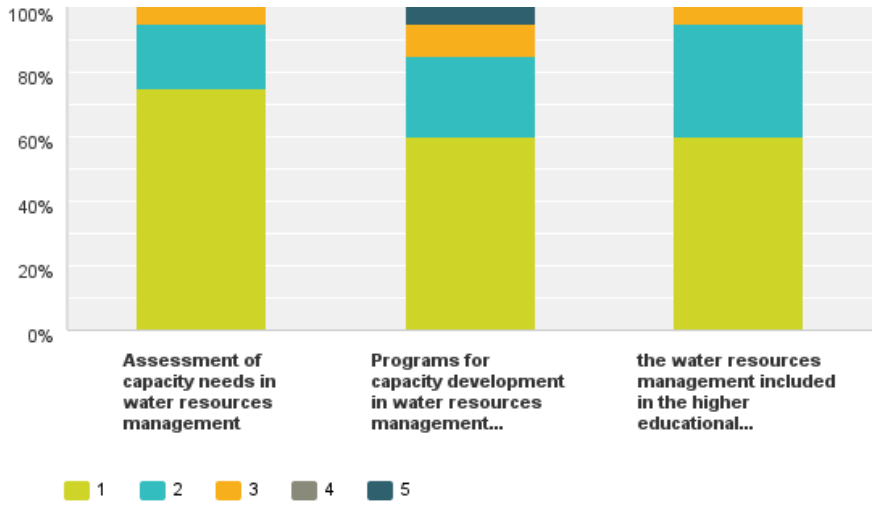
According to the Water Strategy of Syria (2003) and to the United Nations' Water Report (2012), there is a need to develop a qualified staff for water resources management institutions through the following measures:

- Properly assessing capacity needs in water resources management,
- Providing programs for capacity development in IWRM,
- Including the management of water resources in the higher educational agenda and research programs (UN Water Report, 2012; Water Strategy of Syria, 2003, in Arabic).

Knowledge building at both the national and basin level is one of the main aspects of successful water resources management and introduces new multidisciplinary IWRM tools. By rating water as a public and economic good, the current tactics to water resources management should call for incorporation of sectors, comprehensiveness, membership, and cost recovery. Capacity building plans should consider the traditional expertise of hydrology and engineering, economics, law, and ecological and social sciences. The capabilities for water protection and water demand management should be upgraded. The absence of proper expertise and capacity in implementing water resources management activities has contributed to unproductive water resource assessment, wasteful water allocation, and insufficient follow-up on water usage and implementation of law (Water Strategy of Tanzania; 2008).

A qualified staff for water resources management institutions must be developed. This goal can be accomplished through proper assessment of capacity needs in water resources management, providing programs for capacity development in IWRM, and including water resources management in the higher educational curriculum and research programs (see Figure 33).

Figure 33- Experts` views on capacity building in water sector in Syria



Regarding assessment of capacity needs in water resources management, Figure 33 indicates that most participants agreed that the capacity building process in the local water institutions in Syria occurs through identifying the capacity needs in water resources management.
About the programs for capacity development in water resources management institutions and organizations, again the majority of the participants believed programs were available for capacity development in water resources management institutions and organizations.
Concerning the inclusion of water resources management in the higher educational course and research programs, most respondents agreed that water resources management is included in the higher educational curriculum and research programs.
Some participants commented on this question:

- The capacity building is not applied properly lately: indicating the influence of Syrian crises[11].
- The capacity building is existed in the curriculums but the quality of its application is low and there is a lack in the follow-up of the trained personal by not hiring the suitable person in the suitable place by the end of training program.
- The establishment of departments for the development of human resources in the institutions to follow the evolution of employees' performance of employees rather than training without follow-up.

The survey results suggest that the level of action in the capacity building process in water resources management is high, but there is a deficit in the application and follow-up for the trainees. This deficit requires a human resources divisions to monitor the development of working personnel, enhance the training delivery capacity, and create a human resources development strategy to generate personnel capabilities in IWRM.

The majority of respondents confirmed that the capacity building process occurs due to the water strategy plans, as depicted in Figure 33 above. However, the comments to this question indicated a degradation in the training programs due to the political crisis and the lack in follow-

[11] One of the challenges mentioned at the beginning of the survey analysis related to the second question (Q2): The reduction of the number of qualified scientific staff through increased immigration ratio since the crises in Syria (brain drain) can be linked to this set of comments. The Syrian crisis influenced trained staff migration.

up for trained personal. Thus, departments to develop human resources must be established in the institutions to follow the evolution of employees' performance.

Regarding this section of the survey, institutional reforms have been undertaken in the Syrian water sector in accordance with the implementation of legal and policy reforms to reach a high level of cooperative decision-making at the state level, enable management at the water basin level, and to authorize stakeholders' organizations at the communal level. The existing institutional framework in Syria is not suitable for sustainably managing water resources. There is a lack of development and application of some necessary management mechanisms, such as for river basin management, groundwater management, cross-sector water management, trans-boundary water management, and pollution prevention. Newly established decentralized structures for water resources management need to be properly operated and mechanisms for stimulating participation should be enhanced to guarantee stakeholders' input in the decision-making process. The private sector's role should be expanded by concluding management contracts, particularly in the field of water supply and wastewater treatment.

The situation seems better for the capacity building process since the level of training in the field of water resources management is high. However, there is a deficit in the application and follow-up of trainees. This deficit requires establishing a human resources divisions to monitor the development of working personal, enhance the training delivery capacity, and create a human resources development strategy to generate personnel capabilities in IWRM.

6.2.1.3. Management instruments

The third section of the survey addressed the third research objective and included five questions (Q16 to Q20). These questions aimed at estimate the degree of application of management instruments (tools and methods) that qualify decision makers to make balanced and informed selections between alternative arrangements, considering the financial instruments necessary to support sustainable institution, infrastructure, and resources and the services they provide.

6.2.1.3.1. Main tools of water sector development

There is a lack of data and calculations for the water budget at the basin level in Syria. Many of the exploitable reserves remain unknown, as do the annual recharge and other water balance components. The lack of knowledge and assessment is considered a major obstacle in achieving comprehensive management in the exploitation of water resources. Furthermore, the quality and quantity of Syrian water resources are not properly observed due to the absence of

monitoring systems. The formation of policies to prevent the overexploitation and pollution of water resources is affected by the lack of necessary data (INECO; 2009).

Furthermore, the application of any IWRM policy or management tool may require the adjustment of the current policies and the development of a new vision because this integration approach is inconsistent with the existing trends and institutional arrangements and with the goals and forms of sectorial policies. The realization of that purpose is not easy and can be achieved only gradually by developing the capabilities and necessary mechanisms (Abed Rabbouh; 2013, in Arabic).

The region is characterized by a future limitation and potential conflicts regarding water allocation. Thus, designing a national water master plan is necessary. This plan will contain the framework, data, and tools that enable the water authorities to make water programme and strategic decisions grounded on methodical and realistic scenarios (GTZ-Jordan; 2004).

In this context, the water experts were asked to respond to Q16 in which the needed tools, found in the scholarly research review, were listed:

- Long-term basin studies for water resources development and management,
- Periodical assessment of water resources,
- Regulatory norms and guidelines for sustainable development of water resources,
- Programs to value the water-related or environmental services (UN Water Report; 2012; P: 30).

Thus, question 16 was stated as follows: What are the main tools of development of water resources in Syria?:

The most important tools for achieving optimal water resources management are (see Figure 34) the following:

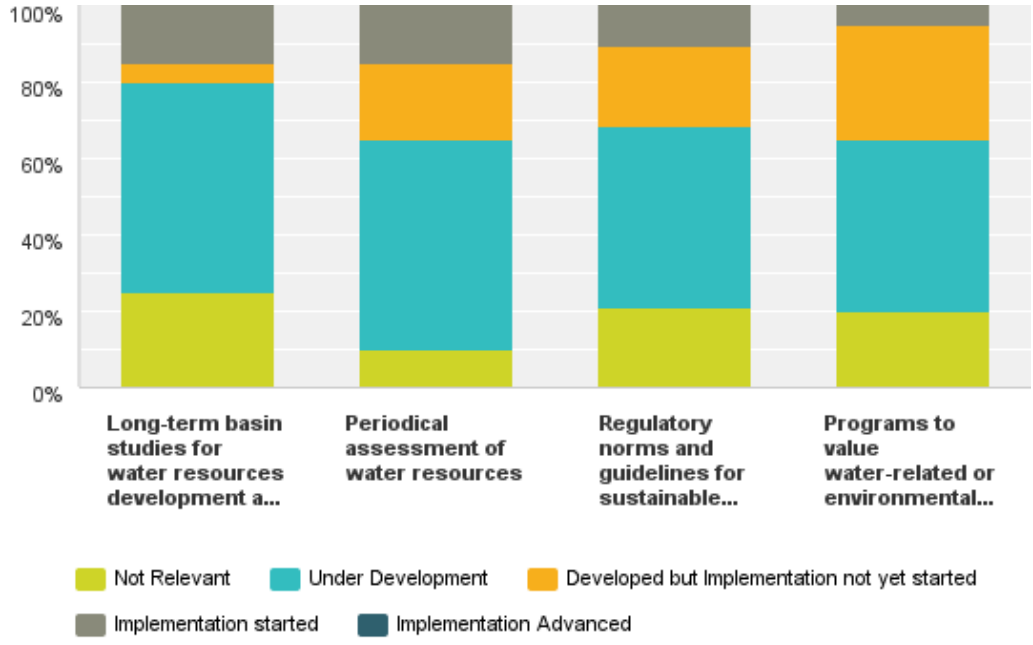
Concerning the long-term basin studies for water resources development and management, Figure 34 illustrates that the most of the participants believed long-term basin studies were under development, while some thought that such studies were not relevant to the Syrian water sector. Only a few experts thought the implementation of these long-term studies had already started.

Regarding the periodical assessment of water resources, most experts believed that the periodical assessment of water resources was under development, some thought the assessment was developed but not yet implemented, and only a few stated the implementation has started.

With respect to regulatory norms and guidelines for sustainable development of water resources, some participants confirmed the absence of such regulatory norms and guidelines, while half believed they were under development. Only a few participants considered these norms to be developed or implemented.

About programs to value the water-related or environmental services:
Some participants said that there is no such program, but about half considered these programs under development. Only a few believed the programs were developed or implemented

Figure 34- Experts` views on the development tools of the Syrian water sector.



The majority of the respondents noted the lack of main development tools in the water sector. In some cases, respondents indicated a high level of implementation of these development tools. which might be considered exceptional and related to a specific pilot project or scientific experiment.

The Syrian Ministry of Irrigation, in cooperation with the Federal Ministry for Economic Cooperation and Development in Germany, adopted the water strategy to develop the water sector in Syria. The water strategy will be supplemented by a set of measures and policies in different sectors related to water to assist in achieving the strategy's objectives. The basis of the IWRM plan elaboration until 2030, between the two Ministries, is represented by this water strategy (Water Strategy of Syria; 2003). According to Kout (2008), the Syrian Arab Republic's water strategy includes plans to modernize the Syrian water sector:

- Updating water resource data and information and establishing a national database,
- Assessing water resources,
- Establishing an integrated and comprehensive water plan for Syria,
- Protecting water resources and controlling pollution (Kout; 2008).

Since 2006, under the international cooperation between the Syrian government and the GTZ, the work has been mainly focused on drafting the institutional procedures for the implementation of IWRM principles. Aiming to promote the administration of the water sector, the Syrian government increased the safeguarding of water resources and the availability of safe drinking water and enhanced the ecological situation. Furthermore, the roles and responsibilities of the stakeholders were clarified. In this period, pilot projects were implemented to initiate stakeholders' discussions about IWRM strategy on the local-level in the 14 governorates. The Syrian State Planning Commission and GTZ are working on a baseline water sector report, which aims to provide a comprehensive, quantitative, and brief overview of water sector services and infrastructure. This report represents a baseline for periodical evaluation of water services and infrastructure and will include the concept of IWRM in its recommendations for improved sector management (GTZ; 2010).

The reviewed literature indicates the introduction of IWRM principles to Syrian water management did not include the application of long-term basin studies, periodical assessment of water resources, regulatory norms for natural resources management, or programs to value environmental services. Since cooperation activities, which have been cancelled due to the Syrian crisis in 2011, were in preparatory stages, there is a similarity between the respondents' views and the reviewed literature. Thus, providing necessary tools for development of the water sector is necessary.

6.2.1.3.2. Water management programs

To discover the availability and status of application of necessary management programs within the Syrian water sector the next question (Q17) was the following (see Figure 35): According to the United Nations' standards regarding the application of IWRM approach (2012), the water resources management process depends on the following programs:

- Ground water management program,
- Surface water management program,
- Linked ground and surface water management program,
- Programs for efficient allocation of water resources among competing uses,
- Land and natural resources program,

- Water allocation with environmental consideration programs,
- Demand management measures for efficient water use in all sectors,
- Program for reusing water,
- Environmental impact assessment program,
- Programs to deal with drought and climate change,
- Cooperative programs for trans-boundary water resources management,
- Programs to reverse environmental degradation.

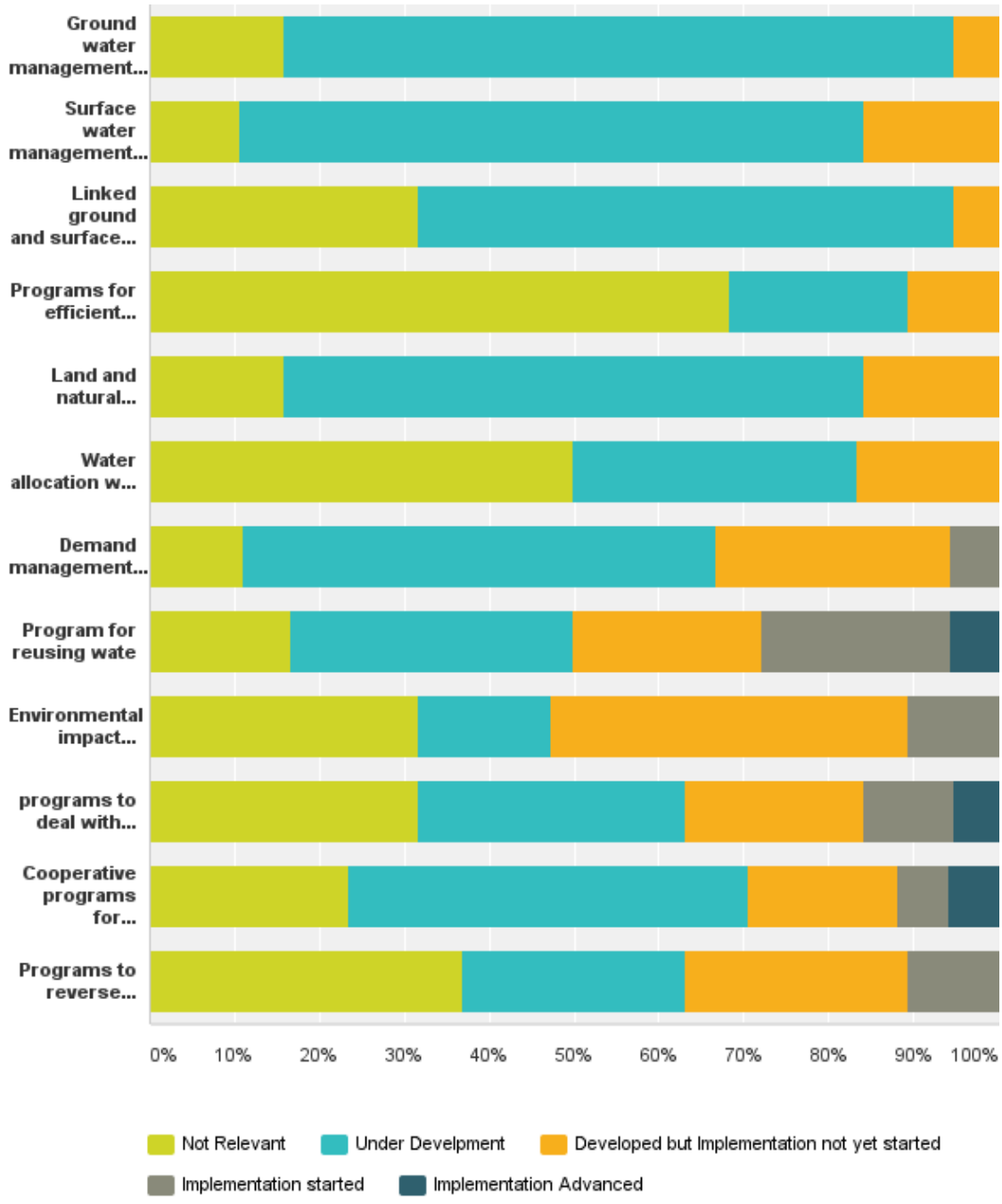
The failed assessment of the quantity and quality of available water resources when developing the water resources has led to the following:

- Overexploitation of surface water resources and drying up of some water springs, producing damage to the ecosystem,
- Overexploitation of ground water resources, negatively upsetting the accessibility of drinking water and strengthening competitive water use in different water sectors.

The scientific and technical information is the main basis of water resources assessment by which the status of surface and ground water resources quality and quantity, and their use within the basin and aquifer boundaries, can be estimated. For improving the management of water resources, it is necessary to organize water monitoring networks, data collection on surface and ground water quality and amount, water withdrawals, and sewage water discharges. Water resources management programmes are related to water sharing, management of a various hydrological components, and ecological issues (UN Water report; 2012).

The necessity of discovering the actual status of the water management tools and programs appears to be essential to determine the deficit areas and the failed updates of these programs (Figure 35):

Figure 35- Experts` views on the status of applied programs in water sector in Syria.



Concerning the ground water management program, Figure 35 presents, the majority of the respondents considered the groundwater management program to still be under development. Regarding the surface water management program, the majority of respondents believed this program was still under development as well.

In relation to linked ground and surface water management program, many participants thought such program did not exist in the water sector of Syria, but most considered it still under development.

The respondents' views indicate the lack of data collection process, which is essential for recognizing the real situation of water resources through periodic reports.

Concerning the programs for efficient allocation of water resources among competing uses, most experts confirmed the absence of this program in the Syrian water sector, while a few thought the program was underdeveloped.

According to Rahaman and Varis (2005), the last three decades of the last century have awakened the awareness of the international community, governments, and politicians about the long-term implications of sectorial and fragmented approaches to water resources management. Thus, many conferences and debates about the economic and social value of water and the technical, legal, and financial tools used in its governance have occurred. These conversations led to a consensus on the need to adopt and publish the principle of integrated management of water resources to ensure water sustainability (Rahaman & Varis; 2005).

Mechanisms to integrate water into economic planning analysis must be developed. These mechanisms should recognize that water and ecosystem are dynamic capital properties with value and raise awareness between participants of the need for incorporated, multi-sectoral organisation.

Regarding the land and natural resources program, the majority of the respondents reported this program was under development, and only a few thought the program was developed but not yet implemented.

In relation to water allocation with environmental consideration programs, Figure 35 illustrates that about half the participants thought this program was not yet introduced to the water sector, while some believed it was under development.

Concerning demand management measures for efficient water use in all sectors, the survey indicates that half the participants considered demand management measures to be under development, and some (30%) believed they were developed but not yet implemented.

The literature suggests that:

> 'water demand management policies aim to intensify water use, optimize water usage, provide more products and services, greater value and ultimately more sustainable development for each unit of water received (rains), extracted (pumping) or produced from salt or brackish water (desalination). The recycling of treated wastewater is on the border between supply and demand. Water Demand Management implies accepting the specific costs in equipment or actions' (Salman; Mualla; 2003; P: 2-3).

The present water sector's policy in Syria, due to the high cost of developing less accessible water, is much more orientated toward demand management, giving more value to the competent utilization of water resources and adopting the basic principles of IWRM (see Section 4.3.4).

The Ministry of Irrigation has taken measurements to manage the water demand. For example, the ministry began converting the old open water canal systems into pipeline systems, encouraging the application of modernized irrigation drip and sprinklers on the farm level, and creating regulations on digging illegal wells. However, the lack of authorization or clear mechanisms for the prohibition of digging wells and the deficient enforcement has caused in great increase in illegal wells in the recent years, causing further exhaustion of the ground water.

Demand management measures exist in the Syrian water sector and are partly implemented. However, these measures must be enforced for water allocation and supply to its different sectors (household, agriculture, industry).

Regarding program for reusing water about half the respondents reported that this program was under development or not relevant, while the other half agreed it was developed and implemented. There was a wide variety of answers to this part of the question.

According to Agha, (2005), many wastewater system networks and wastewater treatment plants are constructed by the government to save the environment and to secure water for agricultural use. However, a large part of untreated wastewater is used for irrigation. Although the image of the sewage system services is positive, since about 93% of the houses in the cities are connected to the wastewater system, most of these systems are implemented with poor quality and are not impermeable. Moreover, several suburbs still need an optimal wastewater system and station for treating wastewater. The ongoing sewage water drainage to the valleys and water bodies or the inhabited lands leads to contaminating surface and ground water resources with microorganisms (Agha et. al; 2008).

According to Syrian National Wastewater Policy (2008), the share of treated wastewater use in agriculture is negligible compared with the expansion of modern irrigation techniques due to the following:

- Conflicting interests of different stakeholders, which limit the implementation of consistent water policy,
- Limited wastewater collection and treatment capacity,

- Involvement of four ministries in the water and agricultural sector, which cause a deficiency of cooperation and coordination in sewage water treatment.
- Unclear standards for irrigation water, leading to no clear definition for reuse of wastewater in irrigation, which is excluded from reuse.
- Low water charges not covering the full cost of O&M and expansion of the facilities (Syrian National Report on Wastewater; 2008).

The literature review findings are similar to many respondents' opinions, which indicates low level application of wastewater management programs. Therefore, these programs should be expanded by building new water treatment plants to cover the entire inhabited lands and increase the treatment capacity of wastewater.

Concerning environmental impact assessment program, Figure 35 indicates that many participants considered the environmental impact assessment program to be developed but not yet implemented, while others confirmed the absence of such program.

According to the Syrian National Policy (2012), environmental degradation is gradually increasing due to uncertainty in applying the environmental laws, lack of the wastewater and agricultural water treatment plants, absence of an environmental database, and the impact of the Syrian crises (National Policy of Syria; 2012). The environmental law is still not fully applied due to a lack of political willpower. Environmental impact assessments are being gradually introduced to new facilities, but the development of assurance regimes can be valuable to provide additional incentives for environmentally friendly practices (INECO; 2009).

The survey data is supported by the literature: environmental laws exist in the Syrian water sector, but there is a need to establish a database for environmental data and ensure its application to limit the pollution of water resources.

In relation to programs for dealing with drought and climate change, the survey results reflect diverse answers from the water experts. Many respondents considered this program to be under developed, others thought it was yet not introduced or it was developed but not yet implemented. A few believed the program was implemented.

A number of measures were taken to react to the drought affecting the eastern and northern parts of Syria: food assistance to the affected 30,000 households in Al Hasakeh, provision of seeds to farmers and feed to small-scale herders, licensing to 13,000 previously unauthorized wells for farmers and herders, and further measures. However, the success in combating the

drought were negligible due to the slow recognition of the scale of the problem and the late call for foreign assistance.

Although the Syrian government approved a national drought strategy in 2006, its implementation measures, except for some pilot projects and the National Drought Steering Committee, directed by representative of prime minister, could not be applied due to lack of capacity and limited financial assistance from the donor community (De Schutter; 2010).

This variation in respondents' answers is in line with the literature review, which indicates that drought programs were introduced in Syria, but the scale of the problem was improperly recognized. Thus, the National Drought Strategy should be revised to cope with climate variability through promotion of international cooperation agendas regarding climate change issue since this is a global challenge.

Concerning cooperative programs for trans-boundary water resources management Figure 35 indicates that the majority of the water experts believed such programs were underdeveloped or not relevant, while a few reported that these programs were developed but not implemented. The reviewed literature (see Section 4.6.5) indicated that the basin of Euphrates River is negatively affected by climatic and social conditions and by the ongoing war in the region. The existing agreements about the water allocation between riparian countries are old (since 1980s) and need to be updated in light of the actual climatic, hydrological, and social conditions. The ongoing war is an obstacle to policy cooperation. Building cross-border coordination through establishing institutional capacity, based on stakeholder participation, in form of agreements, treaties, or informal working relationship is required.

Regarding programs to reverse environmental degradation, as illustrated in Figure 35, most respondents thought that such programs were not relevant or were under development, while some thought they were developed but not yet implemented.
Some participants commented to this part of question 17:

- 'Help and support are needed in this area'.
- 'The related efforts against the degradation nowadays are very weak and there is no clear legislations to protect the environment'.

Reversing the negative environmental impact of industrialization is one of the great achievement stories of the recent half century made by the industrial societies during robust economic growth. Technical modernization and the in knowledge revolution, manufacturing, buildings, and transportation systems have increased the efficient exploitation of natural

resources, so many rivers and lakes are clear again and the air and water quality is purer that at any period in the past five decades. In addition, the food provisions are safer than ever before. The government regulations, through taxation, financial incentives, and community actions are the main reasons for these achievements (UN Documents; 1987). According to Chase (2012), the rehabilitation of the Rheine basin is one of the most successful stories about the protection of river water basins. The river was cleaned after implementing a number of protection measures: reducing chemical and toxic effluents from companies and applying adequate environmental measures on both national and international levels (Chase; 2012).

Establishing strategies and action plans for environmental protection in Syria is the responsibility of the Higher Council for the Protection of Environment, which was founded in 1991 and recently amended by the law N.12 in 2012. The Council is also in charge of environmental regulations and conditions and approving emergency plans in response to environmental disasters (Syrian National Report; 2012).

Examples of reversing environmental impact degradation in Syria are absent in the available literature. The data generated from the survey in question 17 (Figure 35) and the opinions of the majority of respondents indicate a lack of programs to reverse environmental degradation. Even for the Higher Council for the Protection of Environment, environmental protection issues were not the highest priority during the crisis in Syria.

Generally, question 17 indicates most of the basic programs for water resources management are under development which are ground and surface water management, efficient allocation of water resources between competing uses, and water allocation with environmental consideration. However, the survey results indicate relatively enhanced level of application of demand management measures for efficient water use in all sectors.

6.2.1.3.3. Monitoring and information management

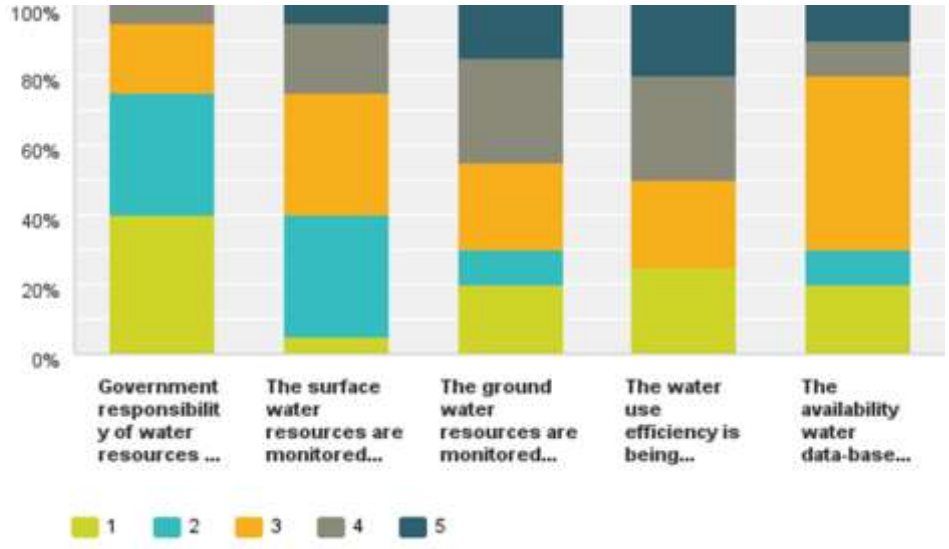
To further explore the degree of application of management instruments, which enables decision making in water management, the question 18 (Q18) focused on the status of monitoring and information management.

According to the water strategy for the modernization of the water sector in Syria, regarding the establishment of optimal monitoring and information management system, the government should be the only responsible and authorized party for water resources, their proper and efficient monitoring, and preparation of water data bank (Water Strategy of Syria; 2003).

To examine the monitoring and information management process within the Syrian water sector, the respondents were asked to respond to Q18: The operation of monitoring and

information management is being conducted properly (where 1 is for the most right and 5 is for the least right).

Figure 36- Experts' views on the status of monitoring and information management in the Syrian water sector



Concerning government responsibility of water resources is addressed in the national legislation, most water experts agreed with this statement, some were unsure, and a few disagreed.

In relation to, proper monitoring of surface water resources, about 40% the respondents agreed that the surface water resources were monitored properly, 35% gave a neutral answer, the rest (25%) disagreed with this statement.

Regarding, the ground water resources are monitored properly, only some of the participants considered the groundwater to be well monitored, while about half disagreed with this statement.

The lack in monitoring surface and ground water may be related to the absence of developed ground water management programs (which was found in Q17).

About the proper monitoring of water use efficiency, many respondents disagreed with this statement; only 25% agreed.

The literature (in Section 4.3.5.) indicates that there is a large number of illegal wells used by farmers in irrigated agriculture activities despite these government's measures. Some farmers still refuse to install water meters for their legal wells, and other farmers use illegal ones, which makes the process of monitoring water use efficiency difficult. Thus, enhancements to monitoring water use efficiency should be created.

Concerning the availability of a water database, which enables one to predict the future of water resources, half the participants were neutral about this statement, some strongly agreed, and others disagreed. In Syria, the water database systems or water bank were newly introduced for only some water basins in rural Damascus and in the coastal region through involvement with international cooperation agencies, like The Japanese International Cooperation Agency (JICA), Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) and Deutsche Geselschaft für Internationale Zusammenarbeit (GIZ)[12].

One comment to this part of the question was as follows:

'A need of linking between the various databases in shape and source'.

The revised literature indicates that the process of updating of the water resources data and establishing a water database to predict future water resources is one of the main objectives of the Syrian Ministry of Irrigation (Kout; 2008). This objective was to be achieved through cooperation with international donor agencies (JICA, BGR and GIZ). However, it is necessary to rebuild the basis of international cooperation in the field of water resources management to ensure sustainable development of water resources.

Thus, the survey results and the reviewed literature indicate that process monitoring and information management is not adequately applied and should be improved.

6.2.1.3.4. Knowledge sharing

Question 19 examined the process of knowledge sharing within the Syrian water sector. The results of survey are presented in Figure 37.

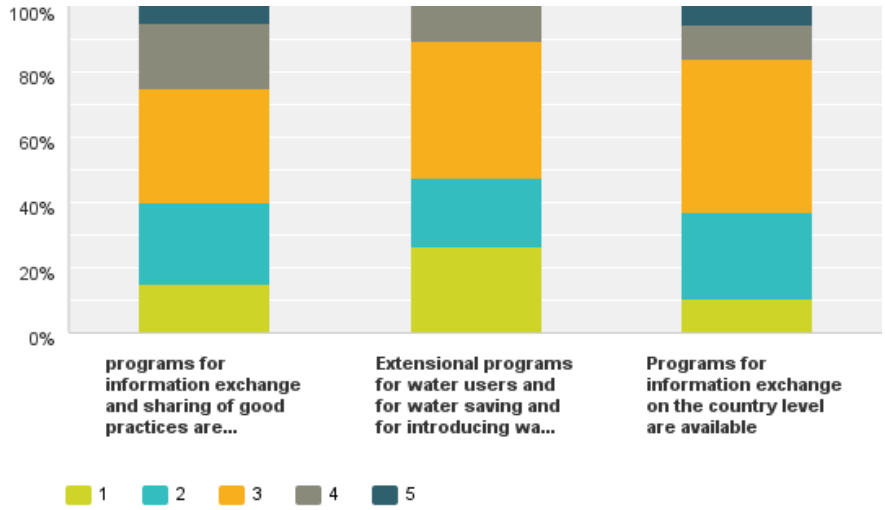
According to the United Nations' recommendations for the application of IWRM (2012), the main criteria for a good knowledge sharing process is to provide (i) programs of information exchange and sharing of good practices, (ii) extensional programs for water users and for water saving and introducing water saving technologies, (iii) programs of information exchange on the country level (UN Water Report; 2012).

Q19: The knowledge sharing process is taking place according to following criteria: (please select from 1 to 5 where 1 is for the most right and 5 is for the least right).

[12] The German Technical Cooperation GmbH (GTZ) has not existed since 1 January 2011. Together with the German Development Service (DED) and InWEnt (Internationale Weiterbildung und Entwicklung gGmbH), it has become part of the German Association for International Cooperation (GIZ).

Regarding programs of information exchange and sharing of good practices, Figure 37 clearly illustrates many water experts (about 40%) agreed that there is such programs of information exchange and sharing of good practices. Some disagreed (25%), and the others were neutral.
In relation to extensional programs for water users and for water saving and introducing water saving technologies, about half of the respondents agreed with this point, and only a few (10%) did not. The rest were unsure.
About programs of information exchange on the country level, many experts (nearly 40%) confirmed the existence of such programs, and only some experts (15%) did not. The rest of the respondents were neutral.

Figure 37- Experts views about the knowledge sharing process in the Syrian water sector



Knowledge sharing in the field of water resources occurred at an acceptable level, especially through the organization of the international cooperation projects, GIZ and JICA, which implemented various extensional programs for water users and changed information on local and international levels.

6.2.1.3.5. Financing of water resources management (economic instruments)

In the following a brief introduction about the applied water pricing system in Syria and then the presentation of the results of the last question in this third section of the survey (Q20), which is about financing of water resources management and the financial instruments that are necessary for supporting the sustainability of organizations, infrastructure and resources and the services they provide.

According to Kaisi (2007), securing the increasing water demand of the growing Syrian population to meet elementary requirements and realize the equivalent economic development is a challenge that outstrips the capacity of society and the national economy. Therefore, the

enhancement of water use efficiency, especially in agriculture, is the first strategic goal of national strategy. Legal, legislative, institutional, and procedural mechanisms, primarily water pricing, must be established. The public authorities face a number of problems related to setting appropriate water price policy due to large inequality among users regarding intake, affordability, and monetary returns gained from water use. The Ministry of Agriculture and Agrarian reform (MAAR), in its letter No. 2408 of 8 November 2003, emphasized the necessity of defining irrigation expenses (O&M) to cover all costs of water availability (Kaisi; 2007).
The price of water in Syria is low compared to its production costs and to the average individual income (Hessian et. al; 2006; in Arabic). The water price must recover the net water production and O&M costs of the water distribution. The differences between water production cost and price for consumers is subsidized by the government as the Syrian legislation refers to water as a public good (Wannous; 2014). The production of one cubic meter of water costs 0.62 Syrian pounds for the lower level, while the real cost of its production reaches 3 Syrian pounds. This tariff system is general for the whole county and does not consider the differences in the quality of supplied water and the length of distribution water networks. The tariffs of wastewater are also paid due to fixed calculated amounts (Hessian et. al; 2006; in Arabic).

The structure of the water tariffs collected from users in the agricultural sector reimburses only a share of irrigation water supply and operation and maintenance cost. This cost is set at US$70/ha and does not include any incentives for water protection. Therefore, it is necessary to apply a volume-dependent cost for irrigation, but there is no strict policy for setting prices for irrigation water and the legal directive for charging the irrigation water cost up to volume-related pricing system is absent. The public irrigation system users are exposed to fees that try to recover a part of the investments made, but the amount is small (US$40-140/ha). The government has issued several legislative decrees and executive decisions to retrieve the cost of the irrigation projects (FAO, AQUA STAT; 2008 and Salman & Mualla; 2004). The charges for water collected from the users covers only 80% of the periodical maintenance cost of the water distribution system. Consequently, there is a high threat that the irrigation infrastructure will suffer from an accelerated degradation due to the lack of necessary maintenance funds (Lamaddalena & Khadra; 2012).

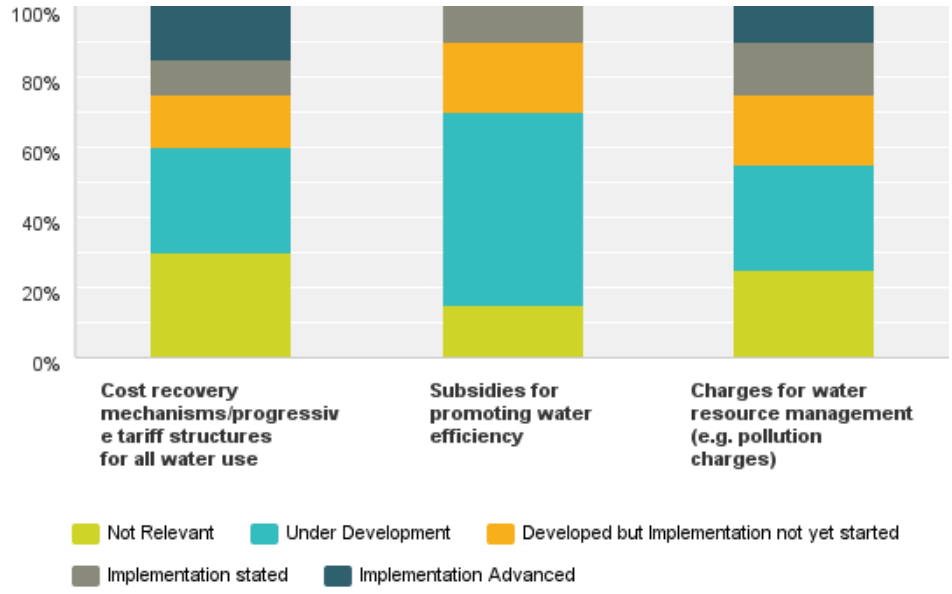
In this context, water-experts were asked to question 20 (Q20): The water resources management are financed through:

(Please mark from 1-5 to indicate the status of financing type where: 1: Not Relevant, 2: Under Development, 3: Developed but implementation not yet started, 4: Implementation started, 5: Implementation advanced).

- Cost recovering mechanisms,
- Subsidies for increasing efficiency of water usage,
- Charges for managing water resources (e.g., pollution charges).

Responses are illustrated in Figure 38 below.

Figure 38- Respondents` views on the financing of water management in Syria



Concerning mechanisms for cost recovery /progressive tariff structures for all water users, most respondents considered cost recovery mechanisms in financing water management to be either not relevant or under development; however, some thought that the implementation was advanced.

Regarding subsidies for promoting water efficiency, the majority of water experts believed these subsidies were under development, and few thought that they were implemented.

About charges for water resource management (e.g., pollution charges), most participants indicated that these charges were either not relevant to the water sector or under development, but other respondents considered the charges developed and even well implemented.

The survey results and the literature clearly indicate that the cost recovery mechanisms, subsidies for promoting water efficiency, and charges for water resource management are underdeveloped in the Syrian water sector.

There is a critical need to create a holistic basin approach that integrates multi-sectoral planning and recognizes the economic value of water to ensure its availability in the needed amount and

quality. Regional inequalities in water supply and wastewater discharge should be maintained by shifting to sector-wide planning according to the water cost recovery principle. The introduction of volume-based tariffs, instead of fixed tariffs, to the agricultural sector and the law enforcement is necessary to confirm the application of the issued governmental decrees for irrigation water cost recovery.

The new water tariff systems should be based on the real costs of providing water services, the different efficiency levels of these services, and water cost recovery. A lifeline tariff should be reserved to protect the poor, using internal subsidizing. Government subsidies should promote the service level.

Mechanisms to control pollution caused by untreated wastewater discharge must be developed and implemented, the polluter pays principle should be applied, and the environmental cost of water should be introduced.

The third section of the water expert's survey suggests the level of management instrument application is low and does not meet the criteria of IWRM. The main tools of water sector development (long-term basin studies, periodical assessment of water resources, and regulatory norms) are absent. All essential tools for water management programmes, except for demand management programmes, are either absent or under development. The process of monitoring and information management is also not adequately applied due to the lack of monitoring networks and encroachment on ground and surface water resources. There is a need to rehabilitate water projects and international cooperation activities, which have been cancelled due to the ongoing war in Syria, in order to facilitate the provision of necessary instruments to manage the water sector in accordance with the IWRM paradigm. The previously concluded agreements about cooperation in the field of water resources management in Syria between Syrian Government and the German Ministry for Economic Cooperation BMZ, represented by GTZ (presently GIZ), should be reactivated to attain the best practice from the extensive German experience in the field of water sector management bearing in mind that IWRM is a comprehensive process that depends heavily on regional and cultural conditions. Thus, for the successful transfer of strategies and solutions from Germany to Syria, it is necessary to define regional, organizational and structural deficiencies and to develop optimized solutions according to the project-oriented management of technical departments and finances.

The knowledge sharing process was nearly properly conducted, but still could not contribute to better decision making due to a lack of general public enforcement. Finally, the cost recovery mechanisms, subsidies for promoting water efficiency, and charges in water resource

management are underdeveloped in the Syrian water sector. The economic value of water must be ensured, and water should be provided by government without financial charges to the beneficiaries. The irrigation charges (O&M) should be cover the availability costs of water for rationing water use in agricultural sector. Subsidies need to focus on supporting farmers who apply water saving irrigation methods (drip, sprinkler) by granting them loans to cover the costs of the pipe-line systems and by calculating the amount of consumed irrigation water. The relationship between relevant organizations concerned with water and water users and polluters should be regulated in accordance with cost recovery and polluter pay principles or water legislation.

6.2.1.4 Infrastructure development and financing

The fourth section of the survey addressed the fourth research objective and had one question (Q21) that investigated development and financing in existing national and investment plans to improve the infrastructure and allocation of finances from both local and international resources.

According to the National Syrian Policy for Science (2012), despite the limitation and the increasing pressure on water resources, the population that have no access to potable water has decreased in the last 20 years. The number of people with access to drinking water increased from 84% in 2000 to more than 94% in 2010, and water production increased from 920 MCM to 1261 MCM. The population connected to the wastewater drainage system also increased, reaching more that 95% in urban areas and 45% in rural areas. However, new treatment plants should be established (National Policy of Syria; 2012).

Access to water has been negatively affected by the conflict in Syria. About two-thirds of the water treatment plants, half of the water pumping stations, a third of the water reservoirs, a quarter of wastewater treatment plants, and a sixth of the wells have been demolished or partially damaged across Syria (WBG; 2017).

Technology and innovation in the water sector in Syria is suffering from structural problems that require scientific solutions and large investments to develop its personnel, institutional structure, and basic infrastructure. Securing the financial resources for the application of these policies is necessary, especially when polices are still under construction and not yet able to self-finance. Finances should not be from one side of the government; rather, various sources of finances are needed to ensure the sustainability of these policies and the investments. The allocating necessary funds in the general budget, encouraging the private sector investments and obtaining maximum benefit from the cooperation agreements with international donor

agencies are the main actions to secure the financial resources for these polices (National Policy of Syria; 2012).

According to Strategic Framework for Cooperation between the Government of Syrian Arab Republic and the United Nations (2016-2017), the Syrian government followed a series of five-year national plans. The last plan (2011–2015) is outdated due to the onset of the crisis. The government is currently developing a framework for national priorities that will include the components envisaged for sustainability: responses to people's and communities' basic needs of people and institutional development. In early 2015, the UN Country Team and the Syrian government discussed a possible plan for cooperation based on resilience and targeted development in response to prevailing conditions. The Syrian strategic framework will contribute to building resilience by achieving specific goals in three priority areas for 2016–2017:

- Institutional development and capacity development
- Renovation and expansion of services and infrastructure
- Improvements to income prospects, economic conditions, and social participation

The required funds for successful implementation will be raised by UN system agencies and local and international private sectors, as well as by allowing individuals, corporations, and foundations in Syria to support the unfunded components of the programme.

When the crisis began, most countries postponed development assistance, except for UN agencies, funds, and programmes and a handful joint partners (SAR & UN; 2016).

The most involved donor international cooperation agencies in the water sector in Syria were GIZ, JICA, and FAO. However, because of the recent political developments in Syria (since 2011), the German government suspended development cooperation activities within Syria until further notice (GIZ; 2018). Likewise, JICA cancelled its cooperation projects in Syria and shifted to development projects assisting Syrian refugees in Jordan (Japanese Initiative for the Future of Syrian Refugees) (JICA; 2018). Thus, FAO is almost the only remaining donor agency still involved in conducting water-related cooperation activities.

According to the FAO (2018) report, a plan of action was developed by the FAO Country Programming Framework to react to the humanitarian crisis affecting Syria and shape the FAO`s assistance in Syria. The plan of action will conduct a comprehensive review of the agricultural sector through wide-ranging users conferences, including government counterparts, sponsoring organizations, NGOs, and the private sector. The creation of complete improvement

programmes and projects beyond humanitarian interferences are expected to be achieved from these consultations**.** The process is aimed at the following:

- Announce government policies and programmes for the agricultural sector,
- Prioritize the country's achievement of the SDGs (2030),
- Contribute to a complete FAO Country Programming Framework (SAR & FAO; 2018).

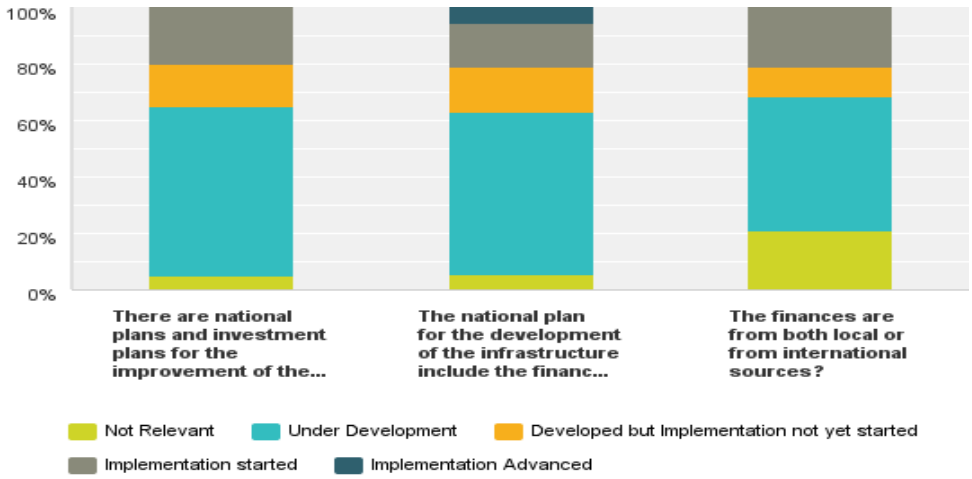
Question 21 (Q21) examined the current process of infrastructure development and financing as necessary conditions to promote technology and innovation in the Syrian water sector: Is the infrastructure development and financing in the water sector being conducted properly?

(Please mark from 1-5 to indicate the status of financing type, where 1: Not Relevant, 2: Under Development, 3: Developed but implementation not yet started, 4: Implementation started, 5: Implementation advanced).

According to the literature, the main requirements for successful infrastructure development and financing are the following (see Figure 39):

- A national plans and investment plans for the improvement of the infrastructure in irrigation, water supply systems, and wastewater treatment plant construction,
- A national plan for the development of infrastructure, including financing for water resource infrastructure.
- Finances from local or international sources.

Figure 39- Respondents views on infrastructure development and financing in Syria



Concerning the national plans and investment plans of infrastructure, Figure 39 indicates that the majority of respondents mentioned that these investment plans were under development; only a few said they were implemented.

- The national plan for the development of the infrastructure, include the financing for water resources infrastructure:

The majority of participants considered the inclusion of financing for water resources infrastructure in the national plan to be under development, and a few considered it to be already implemented.

- The finances are from both local and from international sources:

Most participants did not believe there was enough financial support from both local and international resources.

The results of the survey and the literature review indicate that there is plans to improve and finance the infrastructure, including the improvement and financing of water infrastructure in Syria, such as Strategic Framework for Cooperation between the Government of Syrian Arab Republic and the United Nations (2016-2017) and FAO's plan of action, which will contribute to a complete FAO Country Programming Framework. These plan's finances are also from different sources (international, local, private sector). However, the plan's implementation and their financing are still under development. Facilitating the process of application of such plans is urgent due to their importance in maintaining public services and rehabilitating damaged water infrastructure. The newly approved SDGs (2016-2030) within the 2030 Development Agenda will provide a reference for the strategic implementation of Syria's economic and social advancement plans, including the strategic framework.

6.2.1.5. The development impacts of improved water resources management on the economic, social, and environmental aspects

The fifth section of the survey addressed the fifth research objective and had three questions (Q22, Q23, and Q24) to estimate the overall impact of improved water resources management on the economic, social, and environmental aspects in Syria.

Water resources management is one of the most important contributing factors to development. Questions 22, 23, and 24 estimated the positive impact of applied integrated approaches on the economic, social, and environmental aspects of water resources management over the past five years during the crisis in Syria.

According to the UN's status report, the definitions of the development aspects are as follows: 'Economic development objectives relating to economic growth, wealth, management of monetary assets, and economic sector development,

Social development objectives relating to human development, gender considerations, poverty alleviation, health, education, and job creation,

Environmental objectives relating to the conservation and sustainable use of natural resources, such as water, pollution control, nature, land, forest, and fisheries' (UN Water Report; 2012; P: 70).

6.2.1.5.1. The impact of improved water resources management on the economic development objectives

A number of researchers consider that factors related to water like crop disaster, water limitation, and water mishandling have played a central role in the collapse of the public structure in Syria. This structural breakdown caused massive migrations to Syrian big cities increased unemployment, economic decline, and social unrest (Davis; 2015).

According to study of the National Oceanic and Atmospheric Administration in 2011, Syria is facing an extreme dry period. Syria has experienced a destructive drought since 2006, which caused 85% of the livestock in the country to vanish in the most highly affected regions. About 160 villages were affected by crop failure and farmers migration to urban centres to find jobs and food. The drought has caused a 90% decrease in income for about 1.3 million people (Shank & Wirzba; 2013).

Question 22 (Q22) estimated the overall impact of improved water resources management on the Syrian economic development objectives.

Q 22: To what extent during the last five years were the economic development objectives improved by the water resources management process? (please mark 1 Low to 5 High).

The components of improved water resources management are the following (see Figure 40):

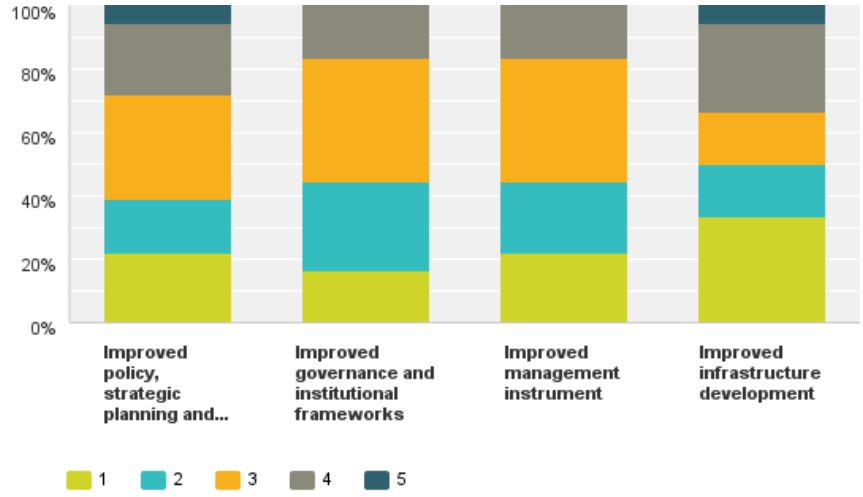
- Improved policy, strategic planning, and legal frameworks
- Improved governance and institutional frameworks
- Improved management instruments
- Improved infrastructure development.

As mentioned, the economic development objectives are related to economic growth, wealth, management of monetary assets, and economic sector development.

According to the US Food and Agricultural Organization report, the wheat production dropped to 18% of the annual average. Syria is not more independent in its wheat production and already imports wheat. Due to its poor economy, the Syrian government organized price offer requests for buying wheat based on Iranian bank credits (Shamout; 2013).

Therefore, the agro-economic policies recently developed in Syria are inefficient and cannot guarantee self-sufficiency food production for the population of Syria.

Figure 40- Respondents' views to the impact of improved water management on the economic development objectives in Syria



Concerning improved policy, strategic planning, and legal frameworks, Figure 40 illustrates, many experts (about 40%) believed the influence of the improved policy, strategic planning, and legal frameworks on the economic development was low. However, about 30% considered the influence high.

Regarding improved governance and institutional frameworks, about half the respondents estimated the influence of improved governance and institutional frameworks on the economic development to be low. Only about 17% considered it to be high.

Relating to improved management instrument, according to half the water experts, the influence of the management instrument on economic development was low; only 17% of respondents thought it was high.

About improved infrastructure development, nearly half the respondents estimated the influence of improved infrastructure development on the economic development was low, and about 30% considered it high.

Generally, the results from survey, similar to the literature, indicate that the impact of the improved water resources management on the Syrian economy was not sufficient.

6.2.1.5.2. The impact of improved water resources management on the social development objectives

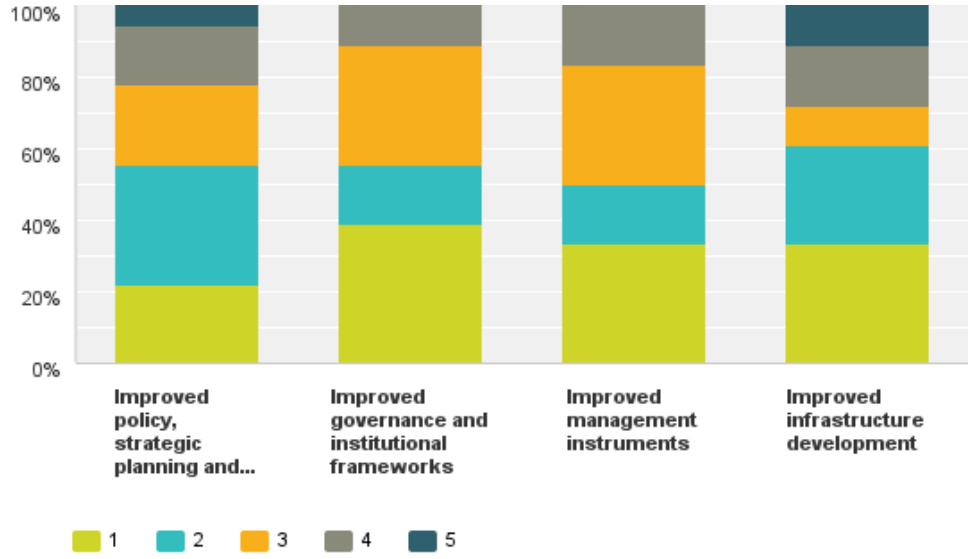
The experts responded to question 23 (Q23) concerning the impact of improved water resources management on the social development objectives relating to human development, gender

considerations, poverty alleviation, health, education, and job creation: To which extent during the last five years were the social development objectives improved by the water resources management process? (please mark from 1 Low to 5 High).

The ongoing conflict in Syria has resulted in a tragic socio-economic situation. The production and distribution of goods and economic activities are disrupted by violence. The population is living under threat of heavy physical harm, have poor nutrition and health services, and face a breakdown of public service delivery. The prospects for the midterm macro-economy hinge on continuing the war and finding solutions to the conflict (World Bank; 2016).

According to the UN publications, in 2015, the displaced population in Syria reached six million people, and the population seeking outside refugee reached four million people. In 2014, the unemployment rate was more than 50% of the population, and the population living under poverty line increased from 12.5% in 2010 to 82.5% in 2014, during the crisis (Shaw; 2018).

Figure 41- Respondents views to the impact of improved water management on the social development objectives in Syria



Concerning improved policy, strategic planning, and legal frameworks, Figure 41 indicates most experts considered the influence of the improved policy, strategic planning, and legal frameworks on the society to be low, and only a few thought it was high.

Regarding improved governance and institutional frameworks, the influence of improved governance and institutional frameworks was also low, according to the majority of respondents.

About improved management instrument, half the participants estimated the influence of management instruments on the social aspect as low, and only a few considered it high.
Relating to improved infrastructure development, Figure 41 clearly illustrates that most water experts estimated the influence of improved infrastructure development on the social development to be low.
The survey responses, similar to the literature, generally indicate limited positive impact of improved water resources management on the Syrian society during the crisis.

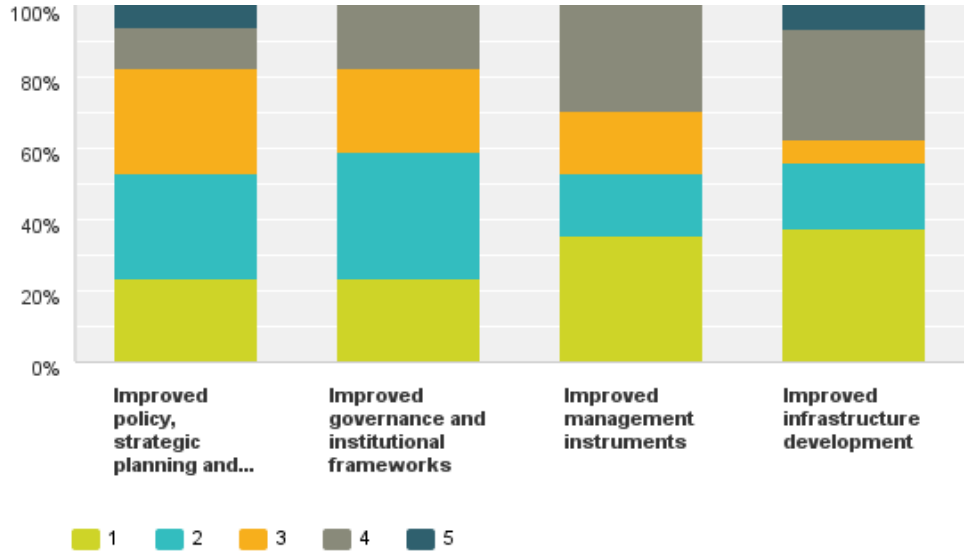
6.2.1.5.3. The impact of improved water resources management on the environmental development objectives:

The last question in the survey (Q24) concerned the impact of improved water resources management on the environmental development objectives relating to the conservation and sustainable use of natural resources, such as water, pollution control, nature, land, forest, and fisheries (see Figure 42): To which extent during the last five years were the environmental development objectives improved by the water resources management process? (1 Low to 5 High).

The Arab Studies Institute mentioned that the Syrian government failed to apply economic procedures to lessen the impact of drought, which led to the expansion of the desert, despite the advancement achieved in improving entree to water. The rural communities have benefited from the established water infrastructure, which expanded the irrigation projects and agricultural production. However, the expansion of irrigated agriculture caused unexpected costs, increased the pressure on the limited water resources and salinity of lands (Saleeby; 2012).

The aridity inflated the impact of poverty and mishandled resources. For example, from the point of view of Syria's farmers, the cause of the steppe desertification was the limited rainfall and temperature increase. However, the ecologists working in Syria found a better explanation for this phenomenon. Extreme grazing of the grasslands, after they were nationalized in 1950, is the main reason for the desertification. The ecological studies conducted in Syria proved that the lands can naturally adapt to changing climatic conditions and survive long-lasting dry periods (Davis; 2015).

Figure 42- Respondents views to the impact of improved water management on the environmental development objectives in Syria.



Concerning improved policy, strategic planning, and legal frameworks, Figure 42 illustrates that the majority of experts estimated the influence of the improved policy, strategic planning, and legal frameworks on the environment to be low.

About the improved governance and institutional frameworks, the influence of improved governance and institutional frameworks on the environment was also estimated to be low by the water experts.

Relating to improved Management instruments, Figure 42 indicates that the majority of participants considered the influence of management instruments on the environmental aspect to be low.

Regarding improved Infrastructure development, the impact of infrastructure development on the environment was also estimated at a low level by most water experts.

The unsustainable water use practices and degradation clearly negatively affect the water resources.

There is a vital obligation to ensure water resources conservation and protection, promoting arrangements to advance an integrated catchment management policy to water resources and to apply obligatory IEAs for all projects related to water resources.

Generally, the fifth section of this survey underlined that the development impacts of improved water resources management on the economic, social, and environmental aspects were applied at a low level. The water resources management process within the Syrian water sector were

implemented without regard to economic and social developments and environmental protection due to unsuccessful water polices and development programs, failed water governance and institutions, lack of appropriate management instruments, and under-developed water infrastructure.

6.3. Interim conclusion

The findings from the empirical study indicate that water policies were at the centre of the country's economic policy discussions. Thus, to introduce IWRM to its water sector, the Syrian government has made ambitious policies, legal frameworks, and national plans aiming to create the enabling environment of sustainable water resources development and management. However, many plans remained on paper and have never been realized, and the implementation of several measures of newly developed water policy and laws was limited.

To achieve improved water governance and institutional framework, by which policies, strategies, and legislation are able to act, institutional restructurings were undertaken in the Syrian water sector. The institutional development was supported by implementation of legal and policy reforms to reach a higher level of shared decision-making at the national level, facilitate the management at the water basin level, and legitimize water users' structures at the communal level. Therefore, the Syrian government tried to strengthen the existing political, social, economic, and organizational systems by establishing water bodies, institutions, and boards to inspect and facilitate the modernization of the water sector. However, the institutional framework does not meet the IWRM paradigm. The framework lacks many necessary management mechanisms, such as for surface and ground water management, trans-boundary water management, and pollution prevention. Considerable work is needed to ensure real public contribution to the decision-making process in water management. The newly established decentralized structures for water resources management need to be properly operated and mechanisms for stimulating participation should be enhanced to guarantee stakeholders' involvement in the decision-making process. The role of the private sector is also limited and should be expanded by creating legal, regulatory, and monitoring frameworks that guarantee service quality and appropriate standards and concluding management contracts, particularly in the field of water supply and wastewater treatment. Furthermore, many studies and development activities were completed without follow up and with weak law enforcement and unreliably of collected data about water resources, which resulted in long periods of unsustainable water management.

There is a deficit in the application and follow-up of the capacity building process, which requires establishing human resources divisions to monitor the development of working

personnel, enhance the training delivery capacity, and perform a human resources development plan to create personnel capacities in IWRM.

Concerning the availability and level of application of management instruments, needed to support informed decision making, the study found that the level of application of these instruments is limited and does not comply with the main principles of IWRM. There is a lack of configuration of the main tools of water sector development: long-term basin studies, periodical evaluation of water resources, and regulatory standards. The necessary programmes for managing water in terms of monitoring of water resources, efficient water allocation, water reuse, environmental considerations, climate change adoption, and cooperative programmes for trans-boundary water resources are either completely absent or under development.

The process of monitoring and information management is also not adequately applied due to the lack of observing networks and encroachment on ground and surface water resources. Water projects and international cooperation activities, which have been cancelled due to the on-going conflict in Syria, such as the former cooperation with GTZ, must be revived to facilitate the provision of necessary instruments to manage the water sector in accordance with IWRM paradigm.

The application of economic instruments and the method of financing water management, so the cost recovery mechanisms, subsidies for promoting water use efficiency and charges for water resource management in Syrian water sector, are under development. In addition to its social value, the economic value of water should be ensured by the government without financial charges to the beneficiaries. The irrigation charges (O&M) should be defined to compensate the availability costs of water for rationing its use in the agricultural sector.

The national water management strategy needs to focus on strengthening public involvement, adopting new economic and technical instruments in water consuming sectors (especially in agriculture), and planning for interventions at the administrative and institutional level. The inter-relation between competent water authorities and water users and contaminators should be regulated in accordance with cost recovery and polluter pay principles or water legislation.

The process of infrastructure development and finances in Syria was presented through the cooperation programmes with the UN for the realization of the Syrian national plans during the crisis, but this process is still under development. The need to facilitate the process of infrastructure development and finances is urgent due to the plans' importance in maintaining public services and rehabilitating damaged water infrastructure. The newly approved

Sustainable Development Goals of 2016-2030, within the 2030 Development Agenda, provide a framework for the strategic implementation of Syria's economic and social advancement plans, including the strategic framework.

The overall impact of improved water resources management on economic, social, and environmental aspects during the crisis in Syria were estimated at a low level due to ineffective water policies and development programmes, unsuccessful water governance system and institutions, lack of appropriate management instruments, and under-development of water infrastructure.

7. General conclusion and recommendations

The analysis of both the water experts` survey and relevant literature have provided more comprehensive data, increased research validity, and a better understanding of the water sector development in Syria in accordance with IWRM paradigm.

The research study answered the five research questions defining the main challenges of the Syrian water sector and examined its existing enabling environment and its suitability for achieving sustainable water resources management. Furthermore, the study evaluated the existing governance and institutional framework of the Syrian water sector, checked the availability, and estimated the degree of application of its management instruments. The research also examined the ongoing process of development and financing of water-infrastructure and finally estimated the overall impact of water resources management in Syria on economic, social, and environmental aspects.

Access to better water management depends on the existence of highly efficient and effective institutions and qualified and trained personnel to perform the various components of national water policy. These components address institutional shortcomings and develop legislative and administrative environments and the process of training and rehabilitation of human capacity building to ensure the creation of an enabling environment capable of improving water management in Syria.

Thus, to modernize the Syrian water sector according to the IWRM principles, much has to be adjusted. Based on the assessment of this study's findings, recommendation are provided below.

7.1. Improved policy, strategic planning, and legal frameworks

The first recommended step for the formulation of policies is to adopt the Syrian National Policy for Science and Technology and Innovation as a reference document for all activities and events related to water. This document should be the platform from which all concerned parties start to build institutional plans and the overall framework for the construction of all executive interventions. The National Policy for Science and Technology and Innovation is designed to flexibly respond to all changes and alterations to compliance and dynamic needs and demands and the availability of resources to meet the implementation of operational plans. These plans should be designed to accomplish the following:

- React to the humanitarian crisis affecting Syria and secure people`s basic needs,
- Conduct a comprehensive review of the Syrian water sector,

- Involve water users' conferences, including government counterparts, sponsor organizations, NGOs, and the private sector in the current discussions on the development of the water sector,
- Target the construction of wide-ranging development programmes and projects beyond humanitarian involvements,
- Announce the actual water strategy for the development of Syrian water sector,
- Outline a base line strategic framework in accordance with SDGs 2030.

7.2. Improved governance and institutional frameworks

The improvement of governance and institutional frameworks requires the following:

- Studying the renovation and development of water laws for the assessment of water draft laws through the study of the social effects and environmental and economic feasibility,
- Reviewing water plans to develop them to move gradually toward administrative and financial decentralization,
- Formulating a referential study to review and evaluate and modernization of water laws according to the progress of the water consuming sector,
- Preparing a study to develop the mechanism of decision making in the water sector,
- Preparing periodical studies about the extent of law application and its obstacles,
- Developing education and training and introducing high technology concepts to stimulate the process of training and ongoing rehabilitation,
- Preparing a study for improving the existing administrative structures within the water bodies.

7.3. Improving management instruments

To improve management instruments, that allow decision makers to make rational and informed selections between alternative actions, it is necessary to rebuild the basis of international cooperation in the field of water resources management to ensure sustainable development of water resources and secure the missing and deficient management programmes related to water resource monitor, efficient water allocation, water reuse, environmental considerations, climate change adoption, and cooperative programmes for trans-boundary water resources. Recovering the deficit of applied water management programmes in Syria's water sector is prerequisite to the following:

- Establish an information bank or national monitoring centre of water data and water uses in different sectors,

- Assess water resources,
- Protect water resources and pollution control,
- Update water resource studies,
- Increase the efficiency of water use,
- Create knowledge networks among institutions and experts in the field of water,
- Develop a national water master plan, which comprises the structure, statistics, and tools to enable water authorities to make water policy and strategic decisions grounded on methodical and realistic scenarios.

Furthermore, the national water management strategy needs to focus on strengthening public involvement, adopting new economic and technical instruments in water consuming sectors (especially agriculture), and planning for interventions at administrative and institutional levels. The inter-relation between competent water organizations and water users and polluters should be regulated in accordance with cost recovery and polluter pay principles or water legislation.

7.4. Improved infrastructure development and financing

Securing the necessary funding to implement the water policy is essential to put it into practice, especially when these policies are under construction and not able to generate sufficient self-funding. Furthermore, funding should not be limited to government support. Ensuring continuity of this policy requires diversity in funding sources. The following directions to provide adequate funding for the implementation of water policies should be considered:

- Allocate the necessary funds in the budget to cover the investment costs and the ongoing work of the national water system,
- Encourage and stimulate participation of the private sector and co-financing,
- Optimally utilize agreements and partnerships with international donors,
- Find practical ways to market the water sector product to generate new revenues and self-finance.

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9. Annexes related to Survey:

The Annexes related to survey are:

Annex A: The format of the Preliminary (exploratory) Water Survey,

Annex B : The General Water-Experts' Survey.

1.

I am the student Nasr Koki. I am preparing my doctoral dissertation on the subject water management and modernization of water sector in Syria.
This survey is a part of my doctoral study and the information you will provide will be used only in this study for statistical purposes.
I would like to thank you in advance for your time and help by filling in this questionnaire.

أنا الطالب نصر كوكي وأقوم بتحضير رسالة الدكتوراة حول موضوع إدارة المياه وتحديث قطاع المياه في سورية.
هذا الاستبيان يعد جزء من دراستي لنيل درجة الدكتوراة و المعلومات التي ستدلي بها سيتم استخدامها احصائياً فقط و ضمن إطار هذا البحث مع جزيل الشكر لكم لوقتكم و مساعدتكم بملىء هذا الاستبيان

1. Contact information:

Name / الاسم	
Ministry/ Department/ مكان العمل	
Job title / الوظيفة	
E-Mail / عنوان البريد الالكتروني	

2. The Enabling Environment for development and water resources management: البيئة المساعدة

2. What are the major problems and challenges in the Syrian water sector?

ما هي أهم المشاكل و التحديات التي تواجه قطاع المياه في سورية؟

3. Like a Water-Expert how is your current job related to the development of water sector in Syria?

كأخصائي في مجال المياه ما هي صلة وظيفتك الحالية بتطوير قطاع المياه في سورية؟

4. Do you consider the current water policies, legislations and strategic plans as being suitable for managing the water resources properly? Why?

هل ترى أن السياسات المائية والتشريعات والخطة الاستراتيجية الحالية مناسبة لإدارة الموارد المائية بشكل صحيح؟ لماذا؟

5. Do these policies and legislations include any other tools and plans, which may incorporate water resources management? (Land and water resources strategy plan, poverty reduction plan, sustainable development strategy, environmental protection action plan).

هل هذه السياسات والتشريعات تشمل أية أدوات أو خطط تتضمن إدارة الموارد المائية؟
(مثل خطة استراتيجية لإدارة الأراضي والموارد المائية, خطة للحد من الفقر,استراتيجية التنمية المستدامة, خطة عمل لحماية البيئة)

6. Are there any international agreements on shared water resources management?

هل هناك أي اتفاقيات دولية في مجال إدارة الموارد المائية المشتركة؟

3. Institutional frameworks: الإطار المؤسسي

7. Do you think that the existing mechanisms in the water bodies and institutions are effective for cross-sector management of water resources ? Why?

هل تعتقد أن آليات الإدارة الحالية المطبقة في الهيئات و المؤسسات المعنية بالمياه تؤدي إلى إدارة فعالة بين القطاعات المستخدمة للمياه؟ ولماذا؟

8. Do you consider the existing institutional framework stimulates partnership?

هل ترى أن الإطار المؤسسي الحالي يحفز على الشراكة ؟

9. Can the Decentralization in managing the water sector be like an institutional framework, which enables the participation on the local and basin levels?

هل بإمكان اللامركزية في إدارة قطاع المياه أن تكون الإطار المؤسسي الذي يساعد على الشراكة على المستوى المحلي ومستوى الحوض؟

10. Can the decentralisation facilitate the planning and execution too?

هل بإمكان اللامركزية تسريع عمليات التخطيط و التنفيذ أيضاً ؟

4. Stakeholder participation: مشاركة مستخدمي المياه

11. Which are the responsible bodies for managing water resources and how they cooperate with the stakeholders?

من هي الجهات الرسمية المسؤولة عن إدارة المياه و كيف يتم التعاون بينها و بين مستخدمي المياه؟

12. What is the role of general public and civil society in managing water and how they are integrated in planning and execution of water projects?

ما هو دور العامة والمجتمع المدني في إدارة المياه وكيف يتم إدماجهم في تخطيط وتنفيذ مشاريع المياه؟

13. Can the private sector be involved in managing the water resources? And why?

How can we promote the role of private sector?

هل بإمكان القطاع الخاص المساهمة في إدارة الموارد المائية؟ و لماذا؟
وكيف يمكن تعزيز دور القطاع الخاص؟

14. What is women role in water management and how can it be developed?

ما هو دور المرأة في إدارة المياه و كيف يمكن تطويره؟

5. Capacity Building: تأهيل الكوادر

15. Are there programs for capacity development in water resources management organizations? And is there a periodical assessment of capacity needs in water resources?

هل هناك ضمن المؤسسات المعنية بالمياه برامج لتأهيل الكوادر في مجال إدارة الموارد المائية؟
وهل يوجد تقييم دوري للإحتياج التدريبي في مجال الموارد المائية؟

16. Is the water resources management included in the higher educational curriculum and research programs?

هل يتم إدراج إدارة الموارد المائية ضمن المناهج التعليمية و الخطط البحثية؟

6. Water resources development: تطوير الموارد المائية

17. Is there a long-term studies for water resources development and management on basin level?.

هل يوجد دراسات طويلة الأمد لتطوير الموارد المائية على مستوى الحوض؟

18. Are the water resources being evaluated periodically?

هل يتم تقييم الموارد المائية بشكل دوري؟

19. Which regulatory norms and guidelines are considered for sustainable development of water resources?

ما هي المعايير والمواصفات التوجيهية والتنظيمية من أجل التنمية المستدامة للموارد المائية؟

20. Is there any program to estimate water-related ecosystem services?

هل هناك أي برنامج لتقدير خدمات النظم البيئية ذات الصلة بالمياه؟

7. Water resources management programs: برامج إدارة الموارد المائية

21. Which programs for managing the ground water, surface water and ground water with surface water together are available?

ما هي البرامج الموجودة لإدارة المياه الجوفية والمياه السطحية والمياه الجوفية مع المياه السطحية معا؟

22. How can the efficient allocation of water resources among the competing sectors be achieved?

كيف يمكن الوصول إلى تحصيص كفؤ للموارد المائية في ما بين القطاعات المتنافسة؟

23. Is there any programs for conducting this allocation?

هل هناك اية برامج لإجراء هذا التحصيص؟

24. Is there another programs or measures dealing with water management issues?

هل هناك برامج أخرى للتعامل مع قضايا الإدارة المائية؟

8. Monitoring and information management: المراقبة و إدارة المعلومات

25. According to the local water legislation, which is the responsible authority of the hydrological monitoring of the quality and quantity of ground and surface water resources?

من هي الجهات الرسمية المسؤولة وفق التشريع المائي عن المراقبة الهيدرولوجية لنوعية و كمية الموارد المائية الجوفية و السطحية؟

26. Is the task of monitoring the water use efficiency being conducted properely? Why?

هل تتم عملية مراقبة كفاءة استخدام المياه بصورة صحيحة؟ و لماذا؟

27. Is there a water data-base system, which is able to predict the future of water resources?

هل تتوفر قاعدة بيانات مائية التي تمكن من التنبىء بمستقبل الموارد المائية؟

9. Knowledge sharing مشاركة المعارف

28. Which programs are available for information exchange and sharing of good practices?

ما هي البرامج المتوفرة لتبادل المعلومات و مشاركة التجارب الناجحة؟

29. Which extensional programs are available for water users and for water saving and for introducing water saving technologies?

ما هي البرامج الإرشادية المتوفرة لمستخدمي المياه التي تهدف إلى توفير المياه ونشر التقنيات الموفرة للمياه؟

30. Are there programs for information exchange on the international level?

هل توجد برامج لتبادل المعلومات على المستوى الدولي؟

10. Financing of the water management: تمويل إدارة المياه

31. What kind of mechanisms for water cost-recovery from water users are available?

ما هي الآليات المتوفرة لإسترداد قيمة المياه من مستخدمي المياه؟

32. Is there any subsidies for improving water use efficiency?

هل يوجد أية إعانات مالية لتحسين كفاءة استخدام المياه؟

33. What about the taxes or fees for water resource management (pollution charges)?

ما هي الضرائب و المخالفات المتعلقة بإدارة المورد المائي (رسوم تلويث المورد المائي)؟

11. Infrastructure Development and Financing: تطوير البنية التحتية و التمويل

34. Are there national plans and investment plans for the improvement of the infrastructure in irrigation, water supply systems and waste-water treatment plants construction?.

هل توجد خطط وطنية و خطط تمويل تهدف إلى تطوير البنية التحتية في مجالات الري و التزويد بالمياه و بناء لمحطات معالجة مياه الصرف الصحي؟

35. Does the national plan for the development of the infrastructure include the financing for water resources infrastructure?

هل تتضمن الخطة الوطنية لتطوير البنية التحتية تمويل البنية التحتية للمواد المائية؟

36. Are the finances from local or from international sources?

هل مصادر التمويل محلية أم دولية؟

12. The impacts of the water resources management in the last 5 years on the development objecitves:

37. To which extent during the last 5 years was the economic development affected by the water resources management process?

(Economic development objectives relating to economic growth, wealth, management of monetary assets, and economic sector development).

ما مدى تأثرالتطور الاقتصادي بعملية إدارة الموارد المائية خلال الأعوام الخمسة الأخيرة؟
(أهداف التنمية الاقتصادية المتعلقة بالنمو الاقتصادي، والثروة، وإدارة الأصول النقدية، وتنمية القطاع الاقتصادي)

38. To which extent during the last 5 years was the social development affected by water resources management process?
(Social development objectives relating to human development, gender considerations, such as poverty alleviation, health, education, and job creation.)

ما مدى تأثرالتنمية الاجتماعية بعملية إدارة الموارد المائية خلال الأعوام الخمسة الأخيرة؟
(أهداف التنمية الاجتماعية المتعلقة بالتنمية البشرية، واعتبارات المساواة بين الجنسين، مثل التخفيف من حدة الفقر، والصحة، والتعليم و ايجاد فرص العمل)

39. To which extent during the last 5 years was the environmental development affected by water Resources management process?
(Environmental objectives relating to the conservation and sustainable use of natural resources, such as water, pollution control, nature, agricultural land, forest, and fisheries.)

ما مدى تأثر التطور البيئي بعملية إدارة الموارد المائية خلال الأعوام الخمسة الأخيرة؟
(الأهداف البيئية المتعلقة بالحفاظ والاستخدام المستدام للموارد الطبيعية، مثل المياه، ومكافحة التلوث، والطبيعة والأراضي الزراعية والغابات و الأسماك)

13. The priorities of the water management challanges:

40. Which priority of water management challanges are there in the water sector of syria?
And how did this priority change before and after the crisis in syria?

ما هو ترتيب الأولويات للتحديات التي تواجه قطاع المياه في سورية؟
وكيف تغير هذا الترتيب قبل وخلال الأزمة الحالية في سورية؟

41. End of the questions thank you a lot.

نهاية الاستبيان شكراً جزيلًا لكم

Datum/Uhrzeit
التاريخ و الوقت

MM TT JJJJ hh mm AM/PM

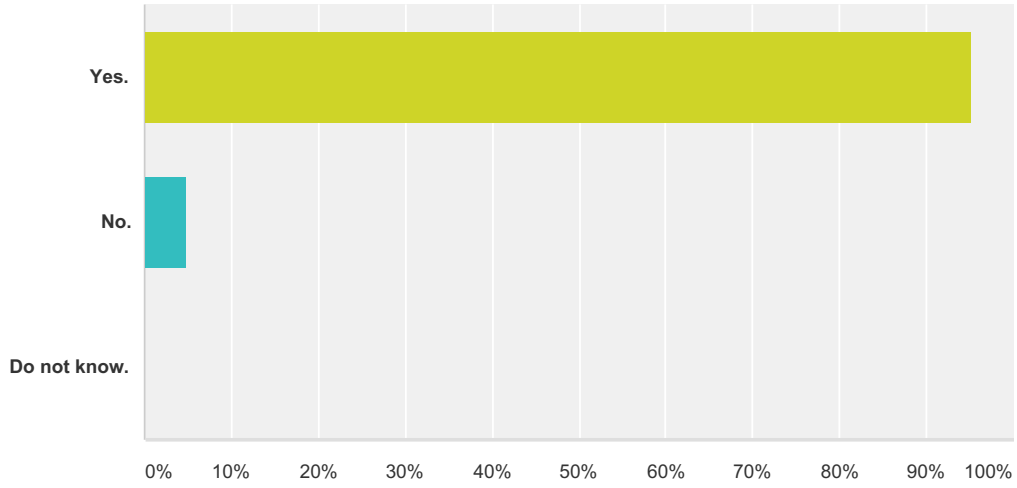
Q1 Contact information

Beantwortet: 19 Übersprungen: 3

Antwortoptionen	Beantwortungen	
Name الإسم	**100,00%**	19
Job title الوظيفة	**89,47%**	17
Ministry and Department مكان العمل	**94,74%**	18
Address 2	**0,00%**	0
City/Town	**0,00%**	0
State/Province	**0,00%**	0
ZIP/Postal Code	**0,00%**	0
Country	**0,00%**	0
Email Address عنوان البريد الإلكتروني	**100,00%**	19
Phone Number	**0,00%**	0

Q2 1- Do you think that the water sector in Syria has a water management problem?
هل تعتقد أن قطاع المياه في سورية يعاني من مشكلة إدارة مياه؟

Beantwortet: 21 Übersprungen: 1

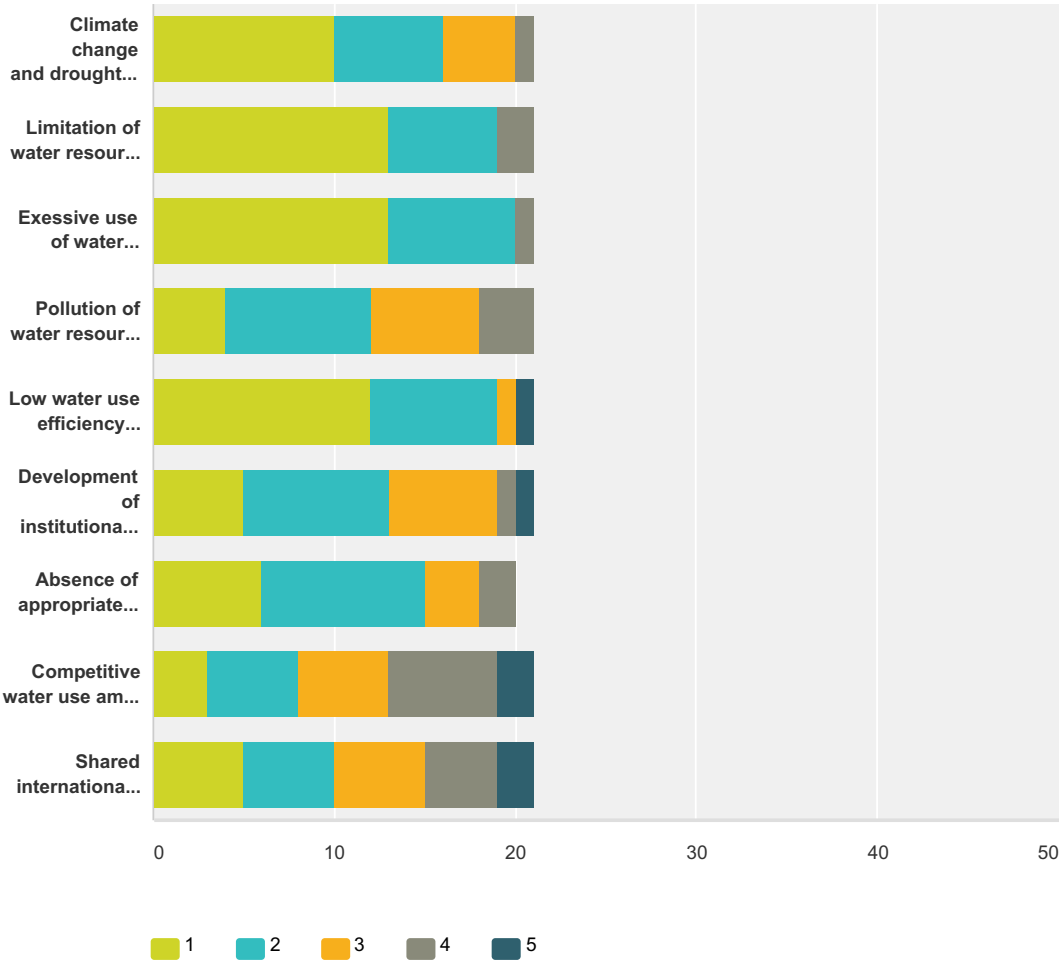


Antwortoptionen	Beantwortungen	
Yes.	**95,24%**	20
No.	**4,76%**	1
Do not know.	**0,00%**	0
Gesamt		**21**

Q3 2- What are the major problems and challenges in the Syrian water sector? Please select from 1 to 5 (where 1 on the left side is for the highest priority and 5 on the right side is for the lowest priority).

ما هي
أهم المشاكل و التحديات التي تواجه قطاع المياه في سورية؟
(الرجاء الإشارة من 1 إلى 5 حيث أن 1 على
اليسار للأهمية القصوى و 5 على اليمين للأهمية الأدنى)

Beantwortet: 21 Übersprungen: 1

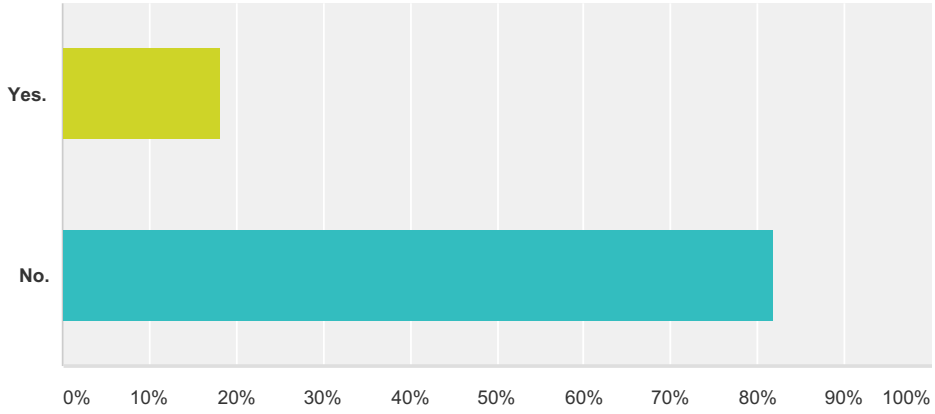


	1	2	3	4	5	Befragte gesamt
Climate change and drought	**47,62%** 10	**28,57%** 6	**19,05%** 4	**4,76%** 1	**0,00%** 0	21
Limitation of water resources	**61,90%** 13	**28,57%** 6	**0,00%** 0	**9,52%** 2	**0,00%** 0	21
Exessive use of water resources	**61,90%** 13	**33,33%** 7	**0,00%** 0	**4,76%** 1	**0,00%** 0	21

Pollution of water resources	**19,05%** 4	**38,10%** 8	**28,57%** 6	**14,29%** 3	**0,00%** 0	21
Low water use efficiency	**57,14%** 12	**33,33%** 7	**4,76%** 1	**0,00%** 0	**4,76%** 1	21
Development of institutional structures of water bodies and authorities	**23,81%** 5	**38,10%** 8	**28,57%** 6	**4,76%** 1	**4,76%** 1	21
Absence of appropriate water management plans	**30,00%** 6	**45,00%** 9	**15,00%** 3	**10,00%** 2	**0,00%** 0	20
Competitive water use among the sector	**15,00%** 3	**25,00%** 5	**25,00%** 5	**30,00%** 6	**10,00%** 2	20
Shared international water resources	**23,81%** 5	**23,81%** 5	**23,81%** 5	**19,05%** 4	**9,52%** 2	21

Q4 3- Do you consider the current water policies, legislations and strategic plans as being suitable for managing the water resources properly? هل ترى أن السياسات المائية والتشريعات والخطة الاستراتيجية الحالية مناسبة لإدارة الموارد المائية بشكل صحيح؟

Beantwortet: 22 Übersprungen: 0

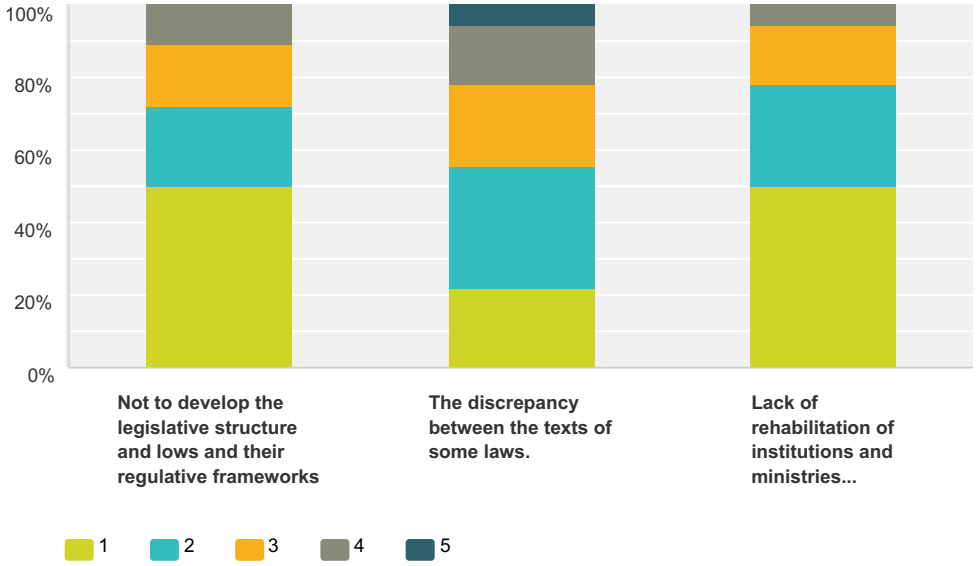


Antwortoptionen	Beantwortungen	
Yes.	**18,18%**	4
No.	**81,82%**	18
Gesamt		**22**

Q5 4- What are the reasons for the inadequacy of current water legislation and laws for the sustainable water resources management? (Please mark once from 1 to 5 where 1 is for the highest priority 5 is for the lowest priority):

ما هي أسباب عدم ملائمة التشريعات المائية الحالية والقوانين للإدارة المستدامة للموارد المائية؟ (الرجاء الإشارة من 1 إلى 5 حيث أن 1 على اليسار للأهمية القصوى و 5 على اليمين للأهمية الأدنى)

Beantwortet: 18 Übersprungen: 4

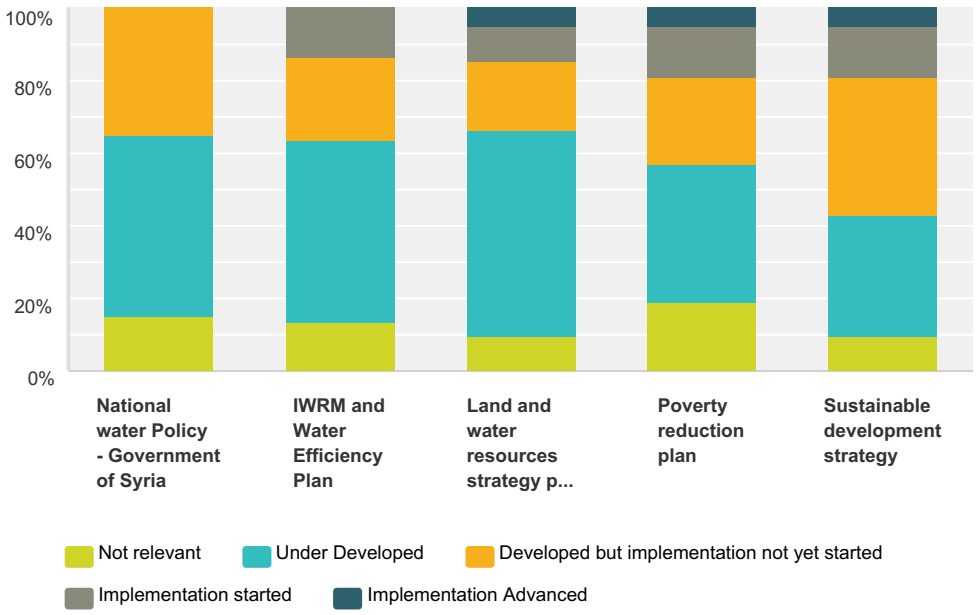


	1	2	3	4	5	Gesamt	Gewichteter Mittelwert
Not to develop the legislative structure and lows and their regulative frameworks	**50,00%** 9	**22,22%** 4	**16,67%** 3	**11,11%** 2	**0,00%** 0	18	1,89
The discrepancy between the texts of some laws.	**22,22%** 4	**33,33%** 6	**22,22%** 4	**16,67%** 3	**5,56%** 1	18	2,50
Lack of rehabilitation of institutions and ministries structures.	**50,00%** 9	**27,78%** 5	**16,67%** 3	**5,56%** 1	**0,00%** 0	18	1,78

Q6 5- Do these policies and legislations include any tools and plans, which may incorporate water resources management? (Please mark from 1 to 5 to indicate the current status of the plans where: 1: is for Not relevant, 2: Under Developed, 3: Developed but implementation not yet started, 4: Implementation started, and 5: Implementation Advanced.)

هل هذه السياسات والتشريعات تشمل أية أدوات أو خطط تتضمن إدارة الموارد المائية؟
يرجى وضع علامة 1-5 للإشارة إلى الوضع الحالي للخطة حيث: 1: غير موجودة، 2: موجودة و غير مطورة)) .
و 3: وضعت ولكن التنفيذ لم يبدأ بعد، 4: بدأ التنفيذ , 5 التنفيذ متقدم

Beantwortet: 22 Übersprungen: 0



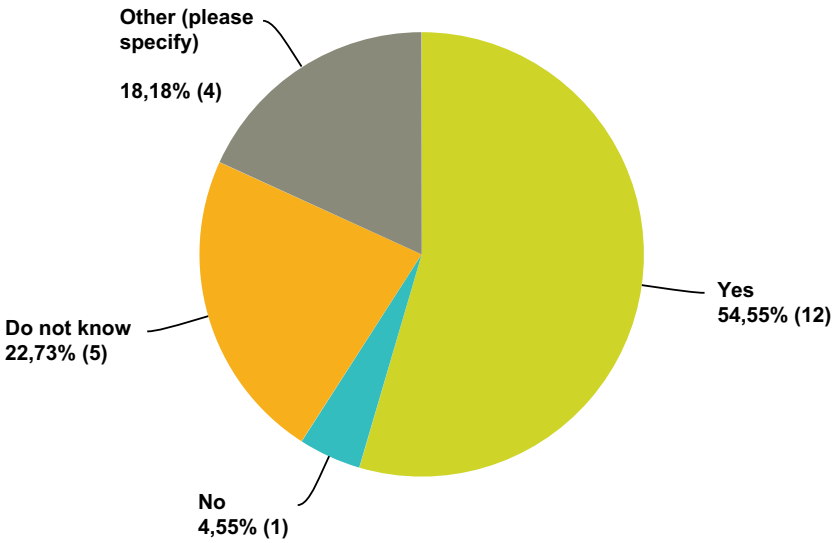
	Not relevant	Under Developed	Developed but implementation not yet started	Implementation started	Implementation Advanced	Gesamt	Gewichteter Mittelwert
National water Policy - Government of Syria	**15,00%** 3	**50,00%** 10	**35,00%** 7	**0,00%** 0	**0,00%** 0	20	2,20
IWRM and Water Efficiency Plan	**13,64%** 3	**50,00%** 11	**22,73%** 5	**13,64%** 3	**0,00%** 0	22	2,36
Land and water resources strategy plan	**9,52%** 2	**57,14%** 12	**19,05%** 4	**9,52%** 2	**4,76%** 1	21	2,43

Poverty reduction plan	**19,05%** 4	**38,10%** 8	**23,81%** 5	**14,29%** 3	**4,76%** 1	21	2,48
Sustainable development strategy	**9,52%** 2	**33,33%** 7	**38,10%** 8	**14,29%** 3	**4,76%** 1	21	2,71

Q7 6- Are there any international agreements on shared water resources management?

هل هناك أي اتفاقيات دولية في مجال إدارة الموارد المائية المشتركة؟

Beantwortet: 22 Übersprungen: 0



Antwortoptionen	Beantwortungen	
Yes	54,55%	12
No	4,55%	1
Do not know	22,73%	5
Other (please specify)	18,18%	4
Gesamt		22

Q8 7- The existing Institutional framework in the Syrian water sector is suitable/ not suitable for achieving sustainable development in water resources, because it contains the following mechanisms:(Please mark from 1 to 5 to indicate the current status of the management mechanism where: 1: Not Relevant, 2: Under Development, 3:Develped but implementation not yet started, 4: Implementation started, 5: Implementation advanced).

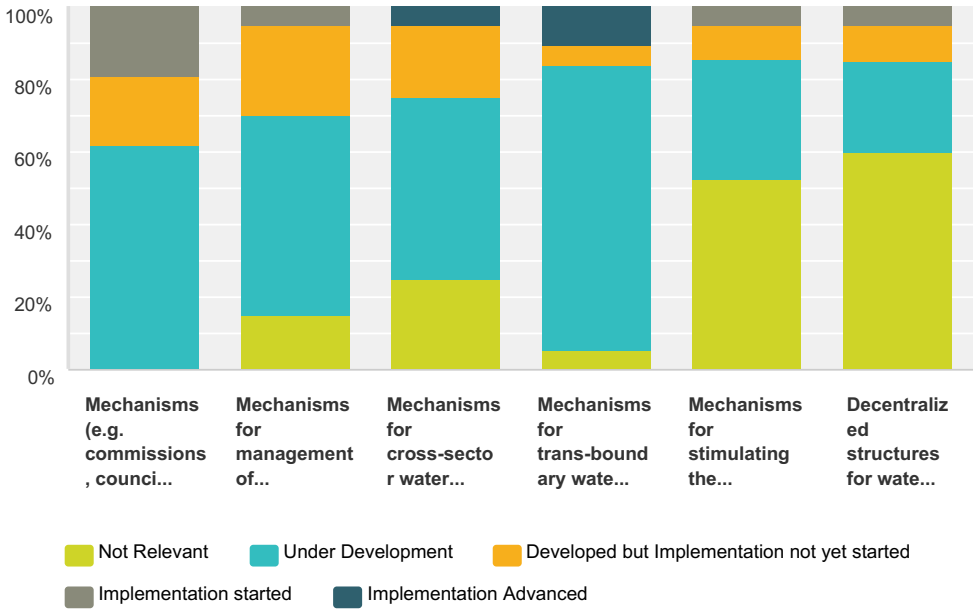
الإطار المؤسسي الحالي في قطاع المياه في سورية هو ملائم / غير ملائم لتحقيق التنمية المستدامة في الموارد المائية

:و ذلك لتوفر

الآليات التالية فيه؟ يرجى وضع علامة 5-1 للإشارة إلى الوضع الحالي للآلية الموافقة حيث: 1: غير موجودة، 2: موجودة و غير مطورة)

(و 3: وضعت ولكن التنفيذ لم يبدأ بعد، 4: بدأ التنفيذ , 5 التنفيذ متقدم

Beantwortet: 21 Übersprungen: 1

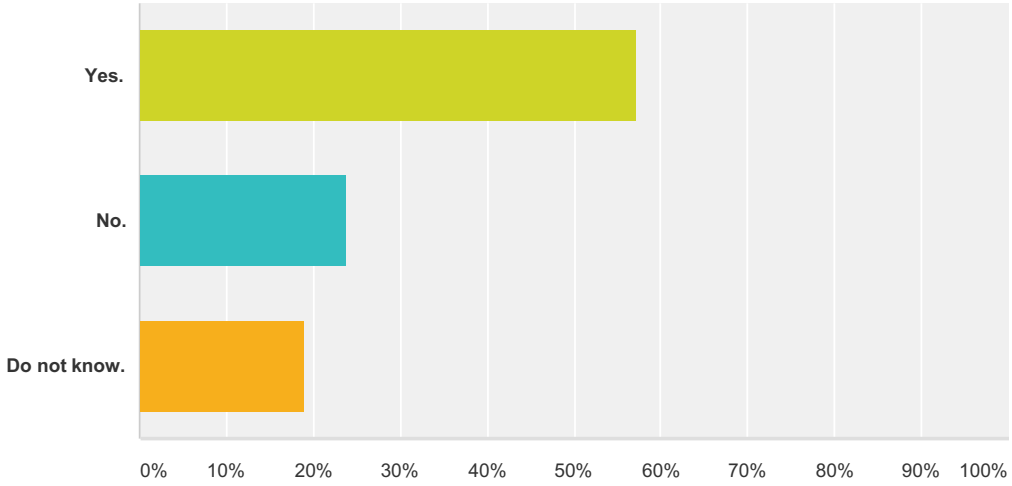


	Not Relevant	Under Development	Developed but Implementation not yet started	Implementation started	Implementation Advanced	Gesamt	Gewichteter Mittelwert
Mechanisms (e.g. commissions, councils) for river basin management	**0,00%** 0	**61,90%** 13	**19,05%** 4	**19,05%** 4	**0,00%** 0	21	2,57

Mechanisms for management of groundwater	**15,00%** 3	**55,00%** 11	**25,00%** 5	**5,00%** 1	**0,00%** 0	20	2,20
Mechanisms for cross-sector water management	**25,00%** 5	**50,00%** 10	**20,00%** 4	**0,00%** 0	**5,00%** 1	20	2,10
Mechanisms for trans-boundary water management	**5,26%** 1	**78,95%** 15	**5,26%** 1	**0,00%** 0	**10,53%** 2	19	2,32
Mechanisms for stimulating the participation	**52,38%** 11	**33,33%** 7	**9,52%** 2	**4,76%** 1	**0,00%** 0	21	1,67
Decentralized structures for water resources management (other than above)	**60,00%** 12	**25,00%** 5	**10,00%** 2	**5,00%** 1	**0,00%** 0	20	1,60

Q9 8- Can the Decentralization in managing the water sector be like an institutional framework, which enables the participation on the local and basin levels? هل بإمكان اللامركزية في إدارة قطاع المياه أن تكون الإطار المؤسسي الذي يساعد على الشراكة على المستوى المحلي ومستوى الحوض؟

Beantwortet: 21 Übersprungen: 1

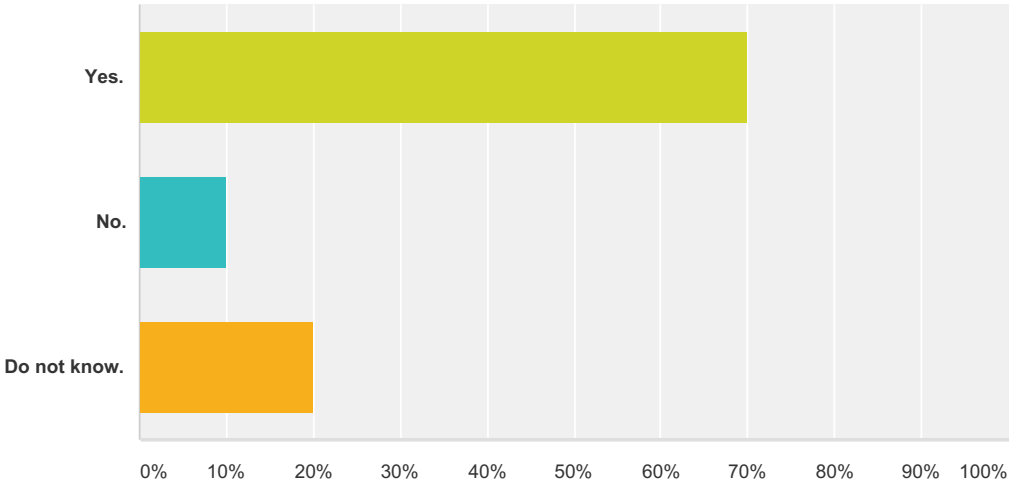


Antwortoptionen	Beantwortungen	
Yes.	**57,14%**	12
No.	**23,81%**	5
Do not know.	**19,05%**	4
Gesamt		**21**

Q10 9- Can the Decentralisation facilitate the planning and execution of water project too?

هل بإمكان اللامركزية تسهيل عمليات التخطيط و التنفيذ أيضاً ؟

Beantwortet: 20 Übersprungen: 2

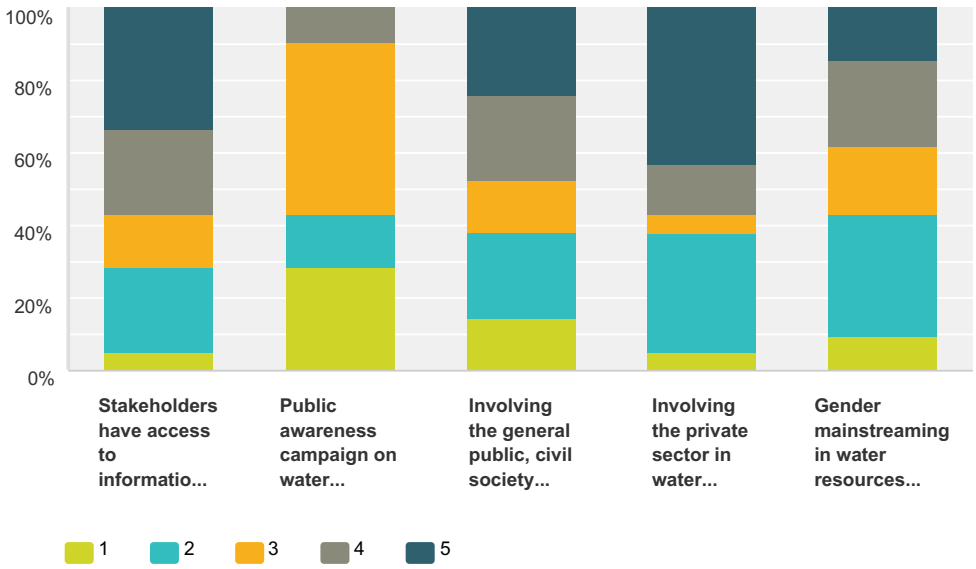


Antwortoptionen	Beantwortungen	
Yes.	**70,00%**	14
No.	**10,00%**	2
Do not know.	**20,00%**	4
Gesamt		**20**

Q11 10- The responsible water bodies and authorities cooperate with stakeholders through:(Please mark once from 1 to 5 where 1: most right and 5 least right).

يتم التعاون ما بين:
الجهات و المؤسسات المعنية بالمياه و بين مستخدمي المياه من خلال ما يلي (يرجى الإشارة من 1 إلى 5 حيث 1: هو الخيار الأكثر صحة و 5: هو الخيار الأقل صحة)

Beantwortet: 21 Übersprungen: 1

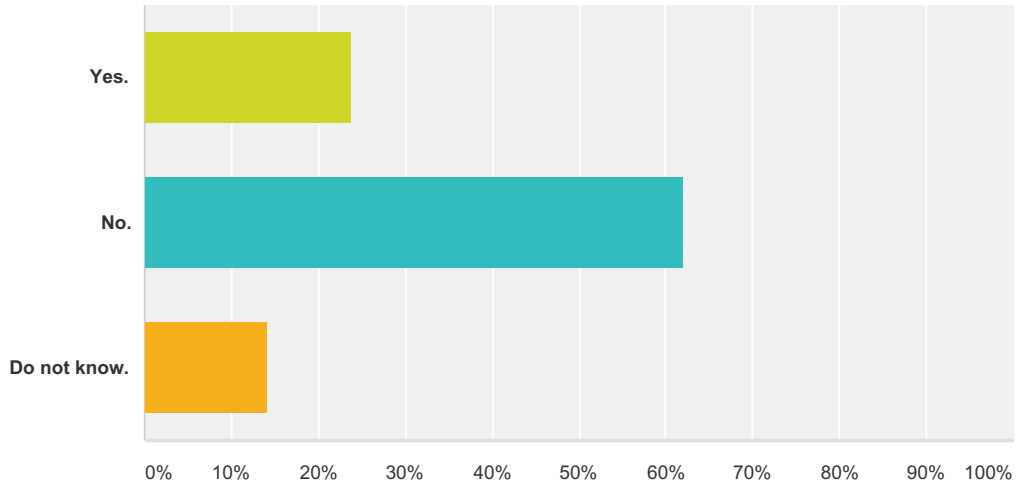


	1	2	3	4	5	Gesamt	Gewichteter Mittelwert
Stakeholders have access to information on national water resources management	4,76% 1	23,81% 5	14,29% 3	23,81% 5	33,33% 7	21	3,57
Public awareness campaign on water resources management and development	28,57% 6	14,29% 3	47,62% 10	9,52% 2	0,00% 0	21	2,38
Involving the general public, civil society organizations and non-governmental organizations in water resources management and development at basin level.	14,29% 3	23,81% 5	14,29% 3	23,81% 5	23,81% 5	21	3,19
Involving the private sector in water resources management and development at the basin level	4,76% 1	33,33% 7	4,76% 1	14,29% 3	42,86% 9	21	3,57
Gender mainstreaming in water resources management and development	9,52% 2	33,33% 7	19,05% 4	23,81% 5	14,29% 3	21	3,00

Q12 11- Do you consider the Privatization of water sector like a good option for achieving a better water resources management?:

هل تعتبر الخصخصة في قطاع المياه خيار جيد للوصول إلى إدارة أفضل للموارد المائية؟

Beantwortet: 21 Übersprungen: 1

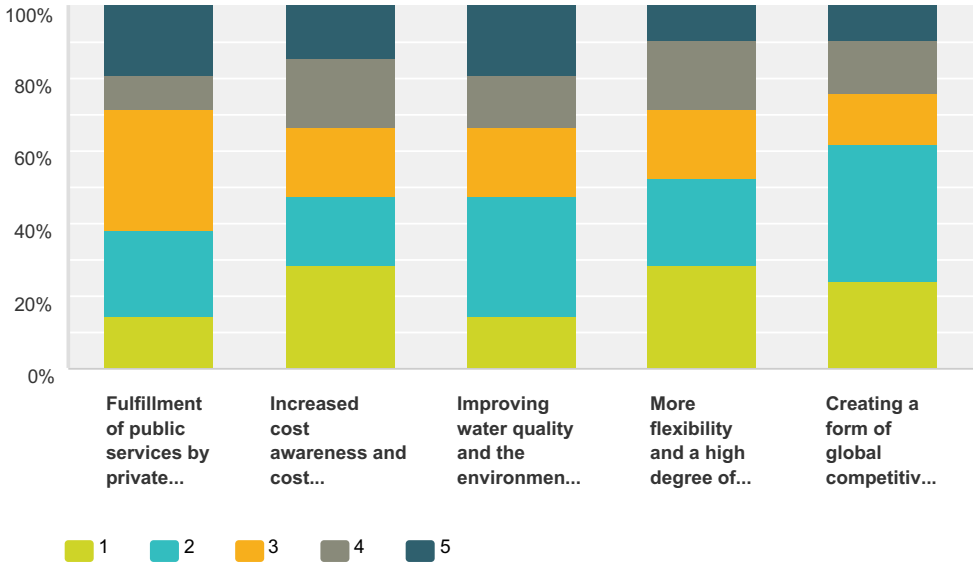


Antwortoptionen	Beantwortungen	
Yes.	**23,81%**	5
No.	**61,90%**	13
Do not know.	**14,29%**	3
Gesamt		**21**

Q13 12- Do you agree that the privatization in water sector has advantages like: (please mark from 1 the most right to 5 the least right)

هل تعتقد أن الخصخصة في قطاع المياه:
لها ايجابيات مثل (يرجى
الإشارة من 1على اليسار إلى 5 على اليمين حيث 1: هو موافق كلياً و 5: هو غير موافق كلياً

Beantwortet: 21 Übersprungen: 1

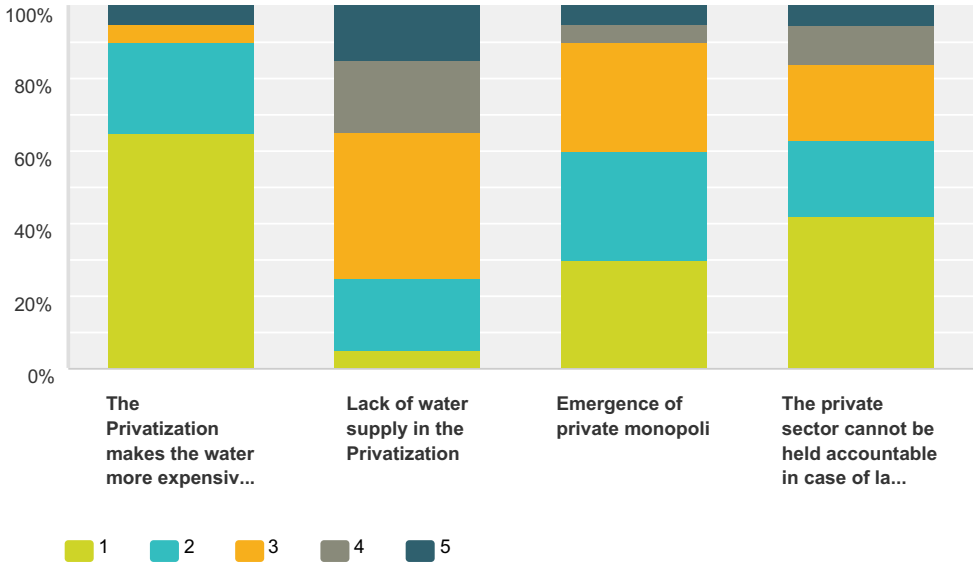


	1	2	3	4	5	Gesamt	Gewichteter Mittelwert
Fulfillment of public services by private investments	**14,29%** 3	**23,81%** 5	**33,33%** 7	**9,52%** 2	**19,05%** 4	21	2,95
Increased cost awareness and cost transparency	**28,57%** 6	**19,05%** 4	**19,05%** 4	**19,05%** 4	**14,29%** 3	21	2,71
Improving water quality and the environment through the technolog	**14,29%** 3	**33,33%** 7	**19,05%** 4	**14,29%** 3	**19,05%** 4	21	2,90
More flexibility and a high degree of objectivity by the higher economic and organizational independence	**28,57%** 6	**23,81%** 5	**19,05%** 4	**19,05%** 4	**9,52%** 2	21	2,57
Creating a form of global competitive business units that operates its services more efficiently	**23,81%** 5	**38,10%** 8	**14,29%** 3	**14,29%** 3	**9,52%** 2	21	2,48

Q14 13- Do you consider that the privatization in water sector has disadvantages like: (please mark from 1 the most right to 5 the least right)

هل تعتقد أن:
الخصخصة في قطاع المياه لها سلبيات مثل
(يرجى الإشارة من 1على اليسار إلى 5 على
اليمين حيث 1: هو موافق كلياً و 5: هو غير موافق كلياً)

Beantwortet: 20 Übersprungen: 2

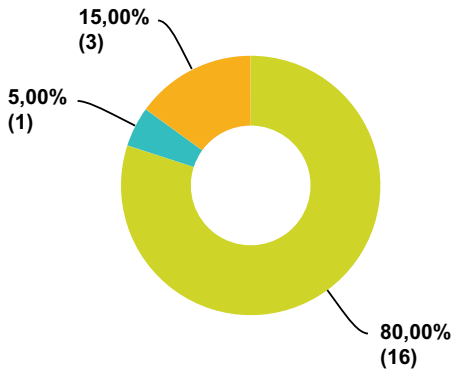


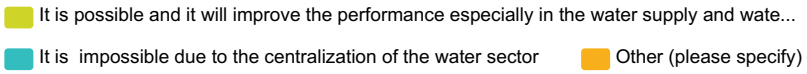
	1	2	3	4	5	Gesamt	Gewichteter Mittelwert
The Privatization makes the water more expensive up to 20% as observed from some of the failed privatization experiments..	**65,00%** 13	**25,00%** 5	**5,00%** 1	**0,00%** 0	**5,00%** 1	20	1,55
Lack of water supply in the Privatization	**5,00%** 1	**20,00%** 4	**40,00%** 8	**20,00%** 4	**15,00%** 3	20	3,20
Emergence of private monopoli	**30,00%** 6	**30,00%** 6	**30,00%** 6	**5,00%** 1	**5,00%** 1	20	2,25
The private sector cannot be held accountable in case of lack of implementation of the services	**42,11%** 8	**21,05%** 4	**21,05%** 4	**10,53%** 2	**5,26%** 1	19	2,16

Q15 14- Can the public and the private sectors cooperate in managing the water resources?

هل بإمكان القطاعين العام والخاص التعاون في مجال إدارة الموارد المائية؟

Beantwortet: 20 Übersprungen: 2



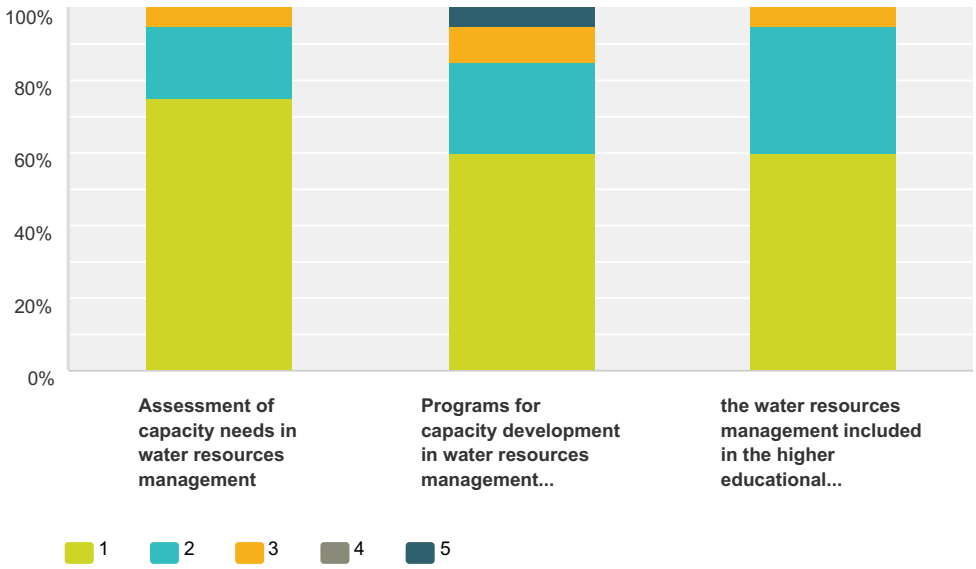


Antwortoptionen	Beantwortungen	
It is possible and it will improve the performance especially in the water supply and water treatment	80,00%	16
It is impossible due to the centralization of the water sector	5,00%	1
Other (please specify)	15,00%	3
Gesamt		20

Q16 15- The capacity building process in the water sector of Syria is taking place according to the following measures: please select from 1 to 5 (where: 1 is for the most right and 5 is for the least right).

تتم عملية تطوير الكوادر في قطاع المياه وفق الإجراءات التالية الرجاء:
الإختيار من 1 إلى 5 حيث 1 الأكثر صحة و 5 الأقل صحة

Beantwortet: 20 Übersprungen: 2

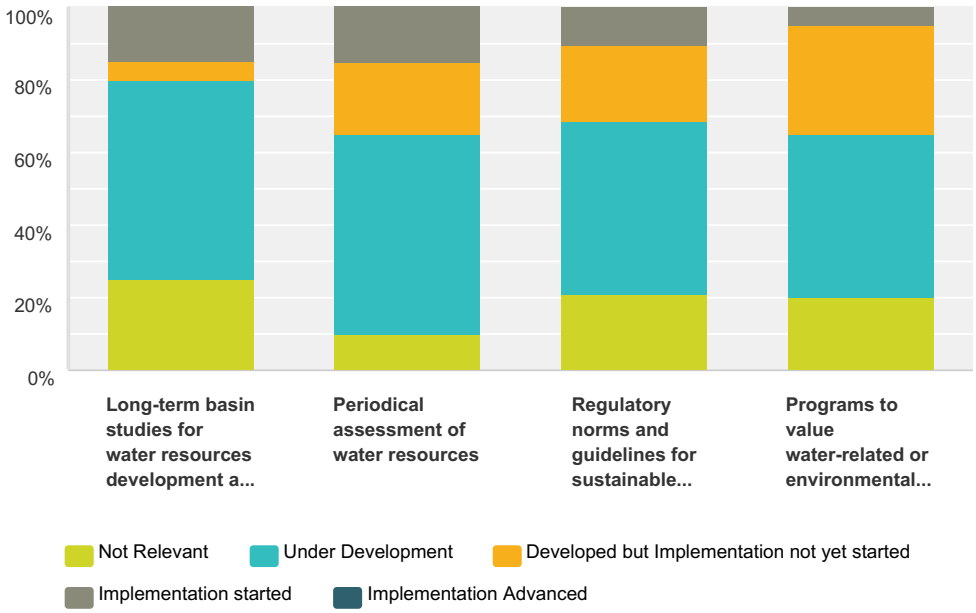


	1	2	3	4	5	Gesamt	Gewichteter Mittelwert
Assessment of capacity needs in water resources management	**75,00%** 15	**20,00%** 4	**5,00%** 1	**0,00%** 0	**0,00%** 0	20	1,30
Programs for capacity development in water resources management institutions and organizations	**60,00%** 12	**25,00%** 5	**10,00%** 2	**0,00%** 0	**5,00%** 1	20	1,65
the water resources management included in the higher educational curriculum and research programs	**60,00%** 12	**35,00%** 7	**5,00%** 1	**0,00%** 0	**0,00%** 0	20	1,45

Q17 16- The water resources in Syria are being developed by means of:(Please mark from 1 - 5 to indicate the status of developing method where: 1: Not Relevant, 2: Under Development, 3: Developed but implementation not yet started, 4: Implementation started, 5: Implementation advanced).

تتم عملية تطوير الموارد المائية في: سورية من خلال اتباع ما يلي يرجى وضع علامة 1-5 للإشارة إلى المرتبة الحالية لنهج التطوير حيث: 1: غير موجود، 2: موجود و غير مطور) و 3: مُعتمد ولكن التنفيذ لم يبدأ بعد، 4: بدأ التنفيذ , 5 التنفيذ متقدم

Beantwortet: 20 Übersprungen: 2

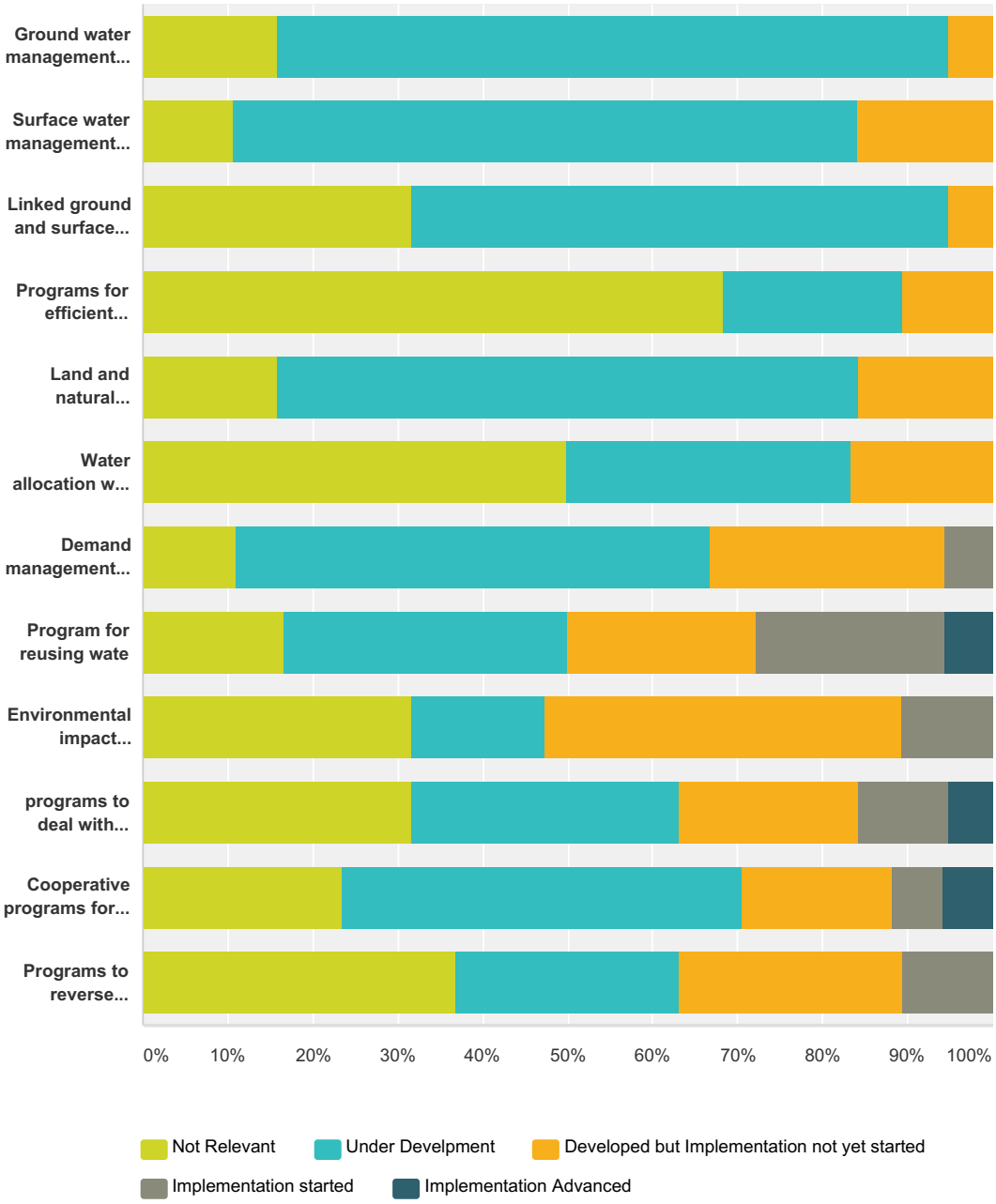


	Not Relevant	Under Development	Developed but Implementation not yet started	Implementation started	Implementation Advanced	Gesamt	Gewichteter Mittelwert
Long-term basin studies for water resources development and management	**25,00%** 5	**55,00%** 11	**5,00%** 1	**15,00%** 3	**0,00%** 0	20	2,10
Periodical assessment of water resources	**10,00%** 2	**55,00%** 11	**20,00%** 4	**15,00%** 3	**0,00%** 0	20	2,40
Regulatory norms and guidelines for sustainable development of water resources	**21,05%** 4	**47,37%** 9	**21,05%** 4	**10,53%** 2	**0,00%** 0	19	2,21
Programs to value water-related or environmental services	**20,00%** 4	**45,00%** 9	**30,00%** 6	**5,00%** 1	**0,00%** 0	20	2,20

Q18 17- The water resources management process depends on the following programs: (Please mark from 1 - 5 to indicate the status of applied program where: 1: Not Relevant, 2: Under Development, 3:Developed but implementation not yet started, 4: Implementation started, 5: Implementation advanced.)

تعتمد عملية إدارة:
الموارد المائية على البرامج التالية يرجى
وضع علامة 1-5 للإشارة إلى الوضع الحالي للبرنامج الموافق
حيث: 1: غير موجود، 2: موجود و غير مطور)
(و 3: مطور ولكن التنفيذ لم
يبدأ بعد، 4: بدأ التنفيذ , 5 التنفيذ متقدم

Beantwortet: 19 Übersprungen: 3



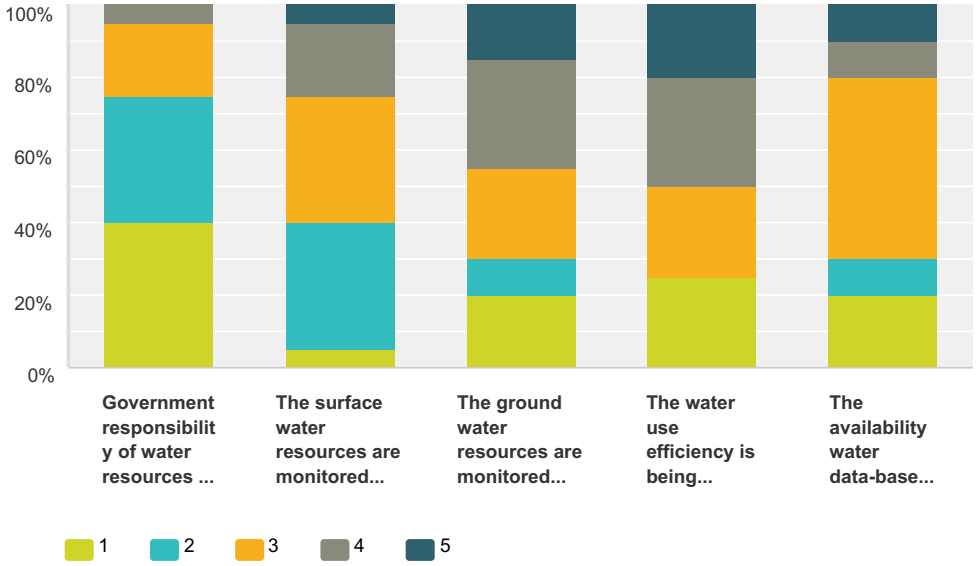
	Not Relevant	Under Develpment	Developed but Implementation not yet started	Implementation started	Implementation Advanced	Gesamt	Gewichteter Mittelwert
Ground water management program	**15,79%** 3	**78,95%** 15	**5,26%** 1	**0,00%** 0	**0,00%** 0	19	1,89
Surface water management program	**10,53%** 2	**73,68%** 14	**15,79%** 3	**0,00%** 0	**0,00%** 0	19	2,05
Linked ground and surface water management program	**31,58%** 6	**63,16%** 12	**5,26%** 1	**0,00%** 0	**0,00%** 0	19	1,74
Programs for efficient allocation of water resources among competing users	**68,42%** 13	**21,05%** 4	**10,53%** 2	**0,00%** 0	**0,00%** 0	19	1,42
Land and natural resources program	**15,79%** 3	**68,42%** 13	**15,79%** 3	**0,00%** 0	**0,00%** 0	19	2,00

Water allocation with environmental consideration programs	**50,00%** 9	**33,33%** 6	**16,67%** 3	**0,00%** 0	**0,00%** 0	18	1,67
Demand management measures for efficient water use in all sectors	**11,11%** 2	**55,56%** 10	**27,78%** 5	**5,56%** 1	**0,00%** 0	18	2,28
Program for reusing wate	**16,67%** 3	**33,33%** 6	**22,22%** 4	**22,22%** 4	**5,56%** 1	18	2,67
Environmental impact assessment program	**31,58%** 6	**15,79%** 3	**42,11%** 8	**10,53%** 2	**0,00%** 0	19	2,32
programs to deal with drought and climate change	**31,58%** 6	**31,58%** 6	**21,05%** 4	**10,53%** 2	**5,26%** 1	19	2,26
Cooperative programs for trans-boundary water resources management	**23,53%** 4	**47,06%** 8	**17,65%** 3	**5,88%** 1	**5,88%** 1	17	2,24
Programs to reverse environmental degradation	**36,84%** 7	**26,32%** 5	**26,32%** 5	**10,53%** 2	**0,00%** 0	19	2,11

Q19 18- The operation of monitoring and information management is being conducted properly because:(please select from 1 to 5 (where: 1 is for the most right and 5 is for the least right).

تتم عملية المراقبة و إدارة المعلومات في:
مجال الموارد المائية بشكل صحيح و ذلك لأن
(الرجاء الإشارة من 1 إلى 5 حيث 1
هو الخيار الأكثر صحة و 5 الخيار الأقل صحة)

Beantwortet: 20 Übersprungen: 2

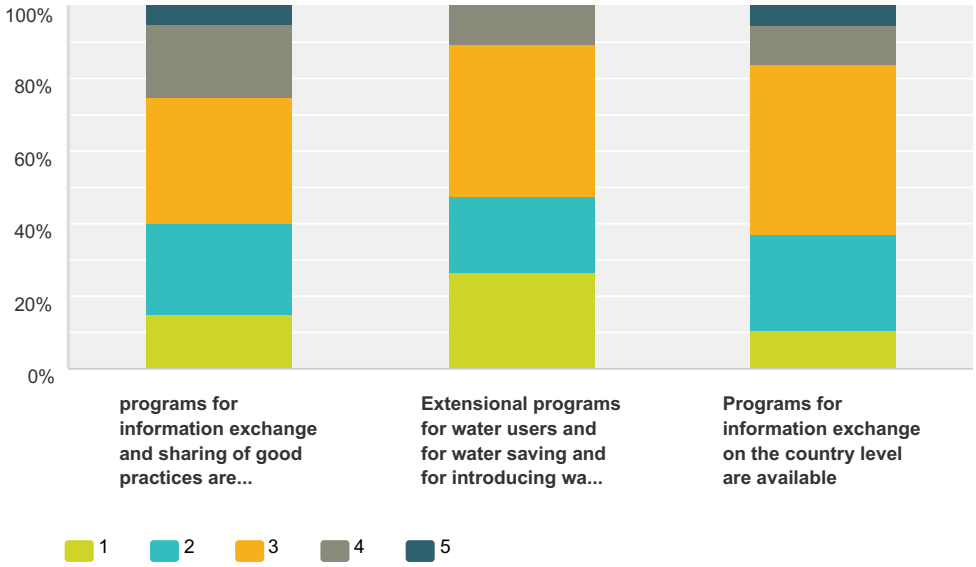


	1	2	3	4	5	Gesamt	Gewichteter Mittelwert
Government responsibility of water resources is addressed in the national legislation	40,00% 8	35,00% 7	20,00% 4	5,00% 1	0,00% 0	20	1,90
The surface water resources are monitored properly	5,00% 1	35,00% 7	35,00% 7	20,00% 4	5,00% 1	20	2,85
The ground water resources are monitored properly	20,00% 4	10,00% 2	25,00% 5	30,00% 6	15,00% 3	20	3,10
The water use efficiency is being monitored properly	25,00% 5	0,00% 0	25,00% 5	30,00% 6	20,00% 4	20	3,20
The availability water data-base system, which is able to predict the future of water resources	20,00% 4	10,00% 2	50,00% 10	10,00% 2	10,00% 2	20	2,80

Q20 19- The knowledge sharing process is also taking place since:(please select from 1 to 5 where: 1 is for the most right and 5 is for the least right).

هناك عملية مشاركة بالمعارف فيما يتعلق:
بالموارد المائية وذلك من خلال
(الرجاء الإشارة من 1 إلى 5 حيث 1 هو الخيار الأكثر صحة و 5 الخيار الأقل صحة)

Beantwortet: 20 Übersprungen: 2

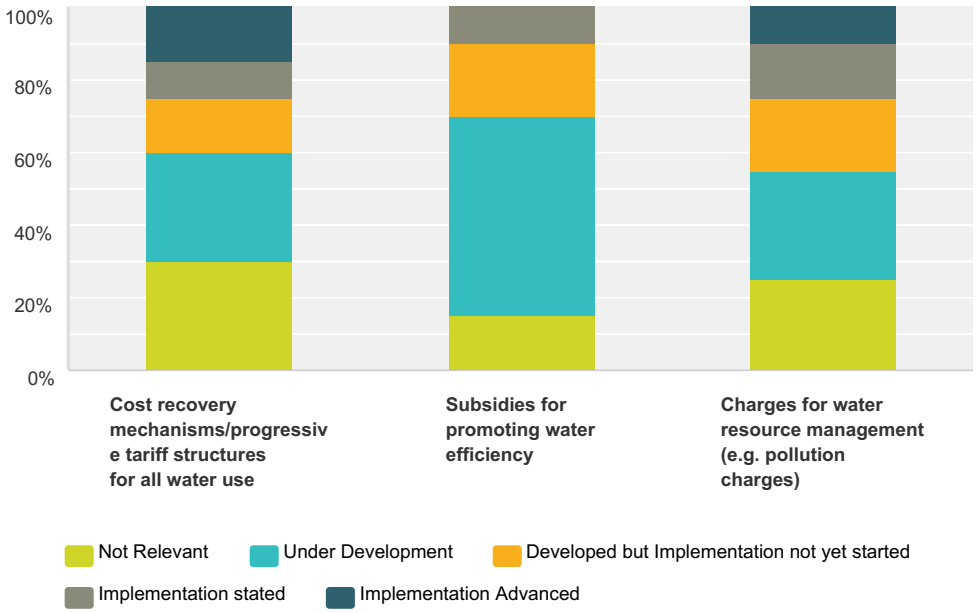


	1	2	3	4	5	Gesamt	Gewichteter Mittelwert
programs for information exchange and sharing of good practices are available	**15,00%** 3	**25,00%** 5	**35,00%** 7	**20,00%** 4	**5,00%** 1	20	2,75
Extensional programs for water users and for water saving and for introducing water saving technologies are available	**26,32%** 5	**21,05%** 4	**42,11%** 8	**10,53%** 2	**0,00%** 0	19	2,37
Programs for information exchange on the country level are available	**10,53%** 2	**26,32%** 5	**47,37%** 9	**10,53%** 2	**5,26%** 1	19	2,74

Q21 20- The water resources management is financed through: (Please mark from 1 - 5 to indicate the status of financing type where: 1: Not Relevant, 2: Under Development, 3: Developed but implementation not yet started, 4: Implementation started, 5: Implementation advanced.)

تتم عملية تمويل الموارد:
المائية من خلال يرجى وضع علامة
1-5 للإشارة إلى نمط التمويل الحالي حيث: 1: غير موجود، 2: موجود و غير مطور)
و 3: مطور ولكن التنفيذ لم يبدأ بعد، 4: بدأ التنفيذ , 5: التنفيذ متقدم)

Beantwortet: 20 Übersprungen: 2

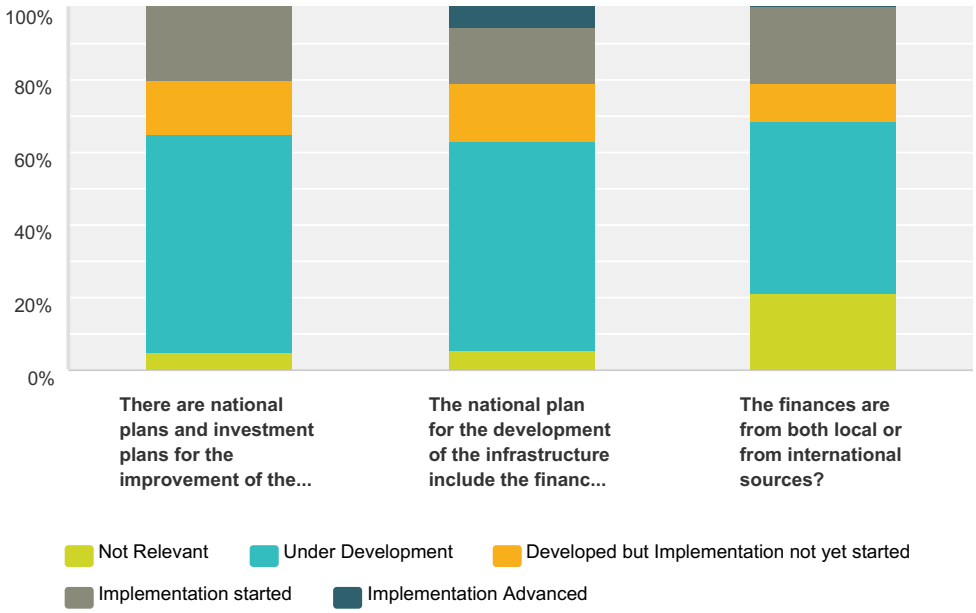


	Not Relevant	Under Development	Developed but Implementation not yet started	Implementation stated	Implementation Advanced	Gesamt	Gewichteter Mittelwert
Cost recovery mechanisms/progressive tariff structures for all water use	**30,00%** 6	**30,00%** 6	**15,00%** 3	**10,00%** 2	**15,00%** 3	20	2,50
Subsidies for promoting water efficiency	**15,00%** 3	**55,00%** 11	**20,00%** 4	**10,00%** 2	**0,00%** 0	20	2,25
Charges for water resource management (e.g. pollution charges)	**25,00%** 5	**30,00%** 6	**20,00%** 4	**15,00%** 3	**10,00%** 2	20	2,55

Q22 21- The infrastructure development and financing in the water sector are on the right way because:(Please mark from 1 - 5 to indicate the status of financing type where: 1: Not Relevant, 2: Under Development, 3: Developed but implementation not yet started, 4: Implementation started, 5: Implementation advanced.)

تتم عملية تطوير و تمويل البنى التحتية ضمن:
قطاع المياه بشكل سليم و ذلك بسبب يرجى وضع
علامة 1-5 للإشارة إلى الوضع الحالي لنمط التطوير و التمويل
حيث: 1: غير موجود، 2: موجود و غير مطور)
(و 3: مطور ولكن
التنفيذ لم يبدأ بعد، 4: بدأ التنفيذ , 5: التنفيذ متقدم

Beantwortet: 20 Übersprungen: 2



	Not Relevant	Under Development	Developed but Implementation not yet started	Implementation started	Implementation Advanced	Gesamt	Gewichteter Mittelwert
There are national plans and investment plans for the improvement of the infrastructure in irrigation, water supply systems and waste-water treatment plants construction	**5,00%** 1	**60,00%** 12	**15,00%** 3	**20,00%** 4	**0,00%** 0	20	2,50
The national plan for the development of the infrastructure include the financing for water resources infrastructure?	**5,26%** 1	**57,89%** 11	**15,79%** 3	**15,79%** 3	**5,26%** 1	19	2,58

The finances are from both local or from international sources?	**21,05%** 4	**47,37%** 9	**10,53%** 2	**21,05%** 4	**0,00%** 0	19	2,32

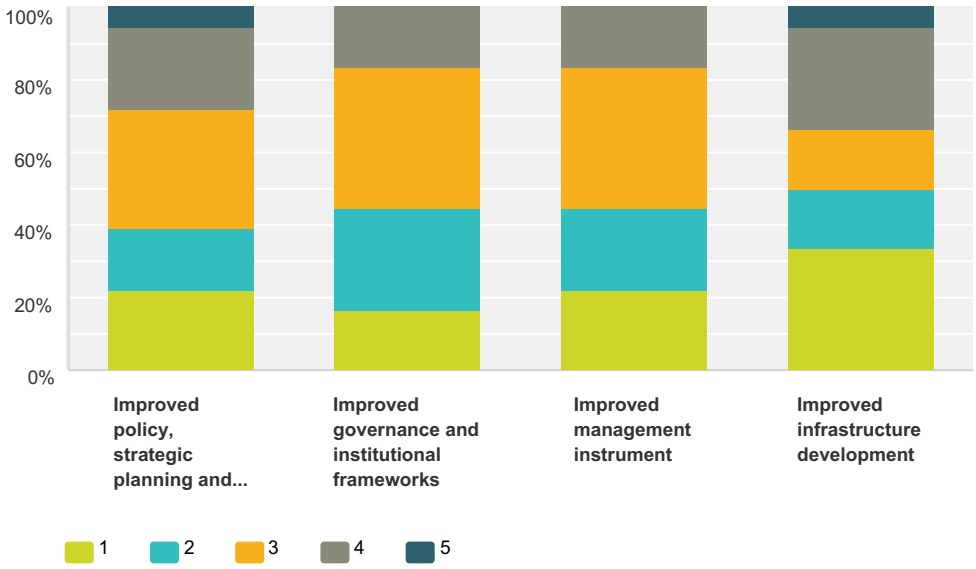
Q23 22- To which extent during the last 5 years were the economic development objectives affected by the improved water resources management process? please mark from 1 low - 5 high (where: the Economic Development Objectives relating to economic growth, wealth, management of monetary assets, and economic sector development.

ما مدى تأثرالتطور الاقتصادي بعملية إدارة الموارد المائية خلال الأعوام الخمسة الأخيرة؟

الرجاء:

الإشارة من 1 منخفض إلى 5 مرتفع
(أهداف التنمية الاقتصادية المتعلقة بالنمو الاقتصادي، والثروة، وإدارة الأصول النقدية، وتنمية القطاع الاقتصادي)

Beantwortet: 18 Übersprungen: 4



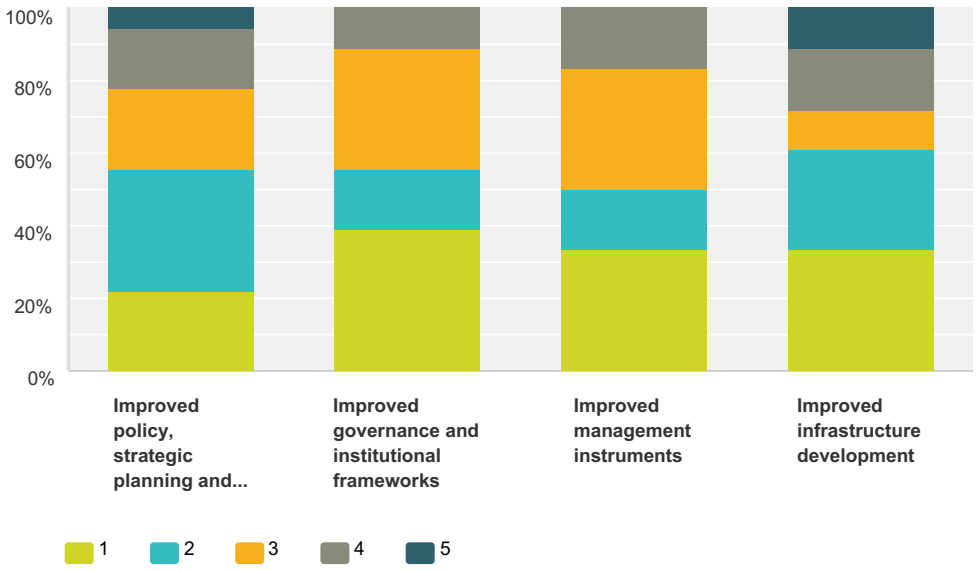
	1	2	3	4	5	Gesamt	Gewichteter Mittelwert
Improved policy, strategic planning and legal frameworks	**22,22%** 4	**16,67%** 3	**33,33%** 6	**22,22%** 4	**5,56%** 1	18	2,72
Improved governance and institutional frameworks	**16,67%** 3	**27,78%** 5	**38,89%** 7	**16,67%** 3	**0,00%** 0	18	2,56
Improved management instrument	**22,22%** 4	**22,22%** 4	**38,89%** 7	**16,67%** 3	**0,00%** 0	18	2,50
Improved infrastructure development	**33,33%** 6	**16,67%** 3	**16,67%** 3	**27,78%** 5	**5,56%** 1	18	2,56

Q24 23- To which extent during the last 5 years were the social development objectives affected by the improved water resources management process? please mark from 1 low - 5 high.Where: the Social Development Objectives relating to human development, gender considerations, such as poverty alleviation, health, education, and job creation. ما مدى تأثرالتنمية الاجتماعية بعملية إدارة الموارد المائية خلال الأعوام الخمسة الأخيرة؟

الرجاء الإشارة: من 1 منخفض إلى 5 مرتفع أهداف التنمية الاجتماعية المتعلقة بالتنمية البشرية، واعتبارات المساواة بين الجنسين، مثل التخفيف من حدة الفقر، والصحة، والتعليم)

و ايجاد فرص العمل)

Beantwortet: 18 Übersprungen: 4



	1	2	3	4	5	Gesamt	Gewichteter Mittelwert
Improved policy, strategic planning and legal frameworks	**22,22%** 4	**33,33%** 6	**22,22%** 4	**16,67%** 3	**5,56%** 1	18	2,50
Improved governance and institutional frameworks	**38,89%** 7	**16,67%** 3	**33,33%** 6	**11,11%** 2	**0,00%** 0	18	2,17
Improved management instruments	**33,33%** 6	**16,67%** 3	**33,33%** 6	**16,67%** 3	**0,00%** 0	18	2,33

Improved infrastructure development	**33,33%** 6	**27,78%** 5	**11,11%** 2	**16,67%** 3	**11,11%** 2	18	2,44

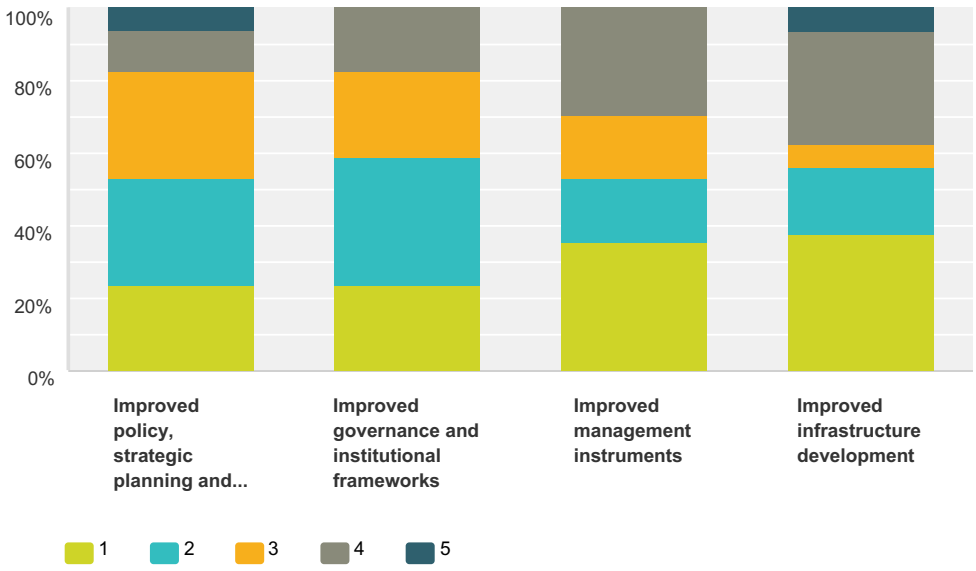
Q25 24- To which extent during the last 5 years were the environmental development objectives affected by the improved water resources management process? please mark from 1 low - 5 high.Where: the Environmental objectives relating to the conservation and sustainable use of natural resources, such as water, pollution control, nature, agricultural land, forest, and fisheries.

ما مدى تأثرالتطور البيئي بعملية إدارة الموارد المائية خلال الأعوام الخمسة الأخيرة؟

الرجاء:

الإشارة من 1 منخفض إلى 5 مرتفع
الأهداف البيئية المتعلقة بالحفاظ والاستخدام المستدام للموارد الطبيعية، مثل المياه، ومكافحة التلوث، والطبيعة)
والأراضي الزراعية والغابات و الأسماك)

Beantwortet: 17 Übersprungen: 5



	1	2	3	4	5	Gesamt	Gewichteter Mittelwert
Improved policy, strategic planning and legal frameworks	23,53% 4	29,41% 5	29,41% 5	11,76% 2	5,88% 1	17	2,47
Improved governance and institutional frameworks	23,53% 4	35,29% 6	23,53% 4	17,65% 3	0,00% 0	17	2,35
Improved management instruments	35,29% 6	17,65% 3	17,65% 3	29,41% 5	0,00% 0	17	2,41
Improved infrastructure development	37,50% 6	18,75% 3	6,25% 1	31,25% 5	6,25% 1	16	2,50

Q26 Thank you very much for filling in the Questionnaire.
نهاية الإستبيان شكراً جزيلاً لكم للإجابة على الأسئلة.

Beantwortet: 16 Übersprungen: 6

Antwortoptionen	Beantwortungen	
Date / Time التاريخ و الوقت	100,00%	16